00052694

NOT TO BE ISSUED
OUT OF THE LIBRARY.

THE
ASIATIC SOCIETY OF BOMBAY
Town Hall, Bombay.

Digitized with financial assistance from the
Government of Maharashtra
on 18 July, 2018

EUCALYPTOGRAPHIA.

A DESCRIPTIVE ATLAS

OF THE

EUCALYPTS OF AUSTRALIA

AND THE

ADJOINING ISLANDS,

BY

BARON FERD. VON MUELLER, K.C.M.G., M. & PH.D., F.R.S.,

GOVERNMENT BOTANIST FOR THE COLONY OF VICTORIA.

5.694
ac

"Non succides arbores, nec securibus debes vastare earum regionem."—*Liber Deuteronomii* xx. 19.

FIRST DECADE.

MELBOURNE:
JOHN FERRES, GOVERNMENT PRINTER.
PUBLISHED ALSO BY GEORGE ROBERTSON, LITTLE COLLINS STREET.
LONDON:
TRÜBNER AND CO., 57 AND 59 LUDGATE HILL; AND GEORGE ROBERTSON, 17 WARWICK SQUARE.

M. DCCC LXXIX.

00052694

INTRODUCTION.

THE issue of this Atlas has been for a long time under contemplation. Indeed material for it accumulated here since 1847, when the author commenced also in reference to the Eucalypts his local Australian studies, ever since carried on as opportunities occurred. But the subject is so large and surrounded by so many perplexities, that even now he can offer his observations only fragmentary. It is acknowledged, that of all generic groups of Australian plants that of Eucalyptus is the most difficult for elaboration. This arises not only from the very large number of species,—Eucalyptus being in this respect solely surpassed by Acacia,—but also because the habitual resemblance of many specific forms is very deceptive; again, because fruits and especially flowers of these trees are not within easy reach of travelling collectors at all seasons; also further, in consequence of several species differing in regard to the persistence or secession of their bark according to geologic influences; and lastly, because the species are distributed over the whole Australian continent and Tasmania, some even extending to the Indian islands, though none occurring in New Zealand. Yet to assign to each species its proper systematic place involves the study of all allied congeners, and these are often not to be found in natural proximity, but only dispersed at wide distances in Australia. Great obstacles arose also in identifying the earlier discovered species, their first description being generally of extreme briefness and imperfection, so much so that it was only in a few of the principal Museum-collections of Europe, where from comparison of autographically named original specimens many of our Eucalypts could be unmistakably recognized. Still already in 1855 and 1856, during Aug. Gregory's expedition, the author endeavoured to shed fuller light on the tropical Eucalypts by close observations instituted in their natural haunts, the results being rendered known in the journal of proceedings of the Linnean Society in 1858, p. 81–101. Similar and still ampler notes were extended connectedly to the extra-tropical species, both eastern and western, in 1860 (Fragm. Phytogr. Austr. ii., 32–71). In these writings many of the characteristics, on which dependence can be placed for specific discrimination in this singular genus, were first drawn into

diagnostic use. These researches formed to a large measure the basis, on which the venerable Mr. Bentham, with access to all the resources then available, and gradually accumulated since the time of Cook's first voyage, built up a complete descriptive system of the species of Eucalyptus in 1866 (Flora Australiensis iii., 185–261).

The primary characteristic for grouping the specific forms (about 140 then being known), which received preference by Mr. Bentham, was derived from the stamens and particularly the anthers; the systematic arrangement thus devised has also since proved the most convenient for easy working with Museum-material, so long as it was the main object to ascertain the name of any species. But the method of grouping adopted by him brings also into close contact most of the Eucalypts, which are bound together by natural affinity. Trifling alterations have however suggested themselves during the actual use of this arrangement; for instance, from the series of "Normales" should be dismembered the subseries of "*Cornutæ*," to which, as forming really a distinct full series, the appellation "Orthostemones" might most expressively be applied; some further separations from the Normales might aptly be effected still, and perhaps some re-arrangements also, in order to bring all the sections of the genus more into values of equality. It might have been advisable to have adopted this method of arrangement for the Atlas also, and to have numbered the plates accordingly; but on full consideration it was deemed best, to leave the lithograms purposely unnumbered, as then the author could move more freely in his choice of the species for successive illustration; moreover, then any one, who had occasion to utilize the Atlas, might unrestrictedly arrange the plates either in accordance with the method derived from the stamens, or according to the cortical system, or at all events merely alphabetically. The issue of the lithograms, thus independent of each other, necessitated also the printing of the text on separate pages for each species, the whole to be bound up on the completion of the work, when the needful indices could be published also. Several additional well-marked species of Eucalyptus have only been discovered during the last few years, whereas other are likely yet to be added from still unexplored tracts of Australia and perhaps the adjoining islands. Any such additional kinds can be inserted at their *right* places into the work, if we remain free from numeric sequence. As however a series of years must necessarily elapse, before the needful funds for the completion of so large a work can gradually be secured, and as moreover plates and text will likely be quoted successively in other publications, it became necessary to adopt at once some form of periodic issue, for which that in decades seemed the most eligible. Meanwhile the enlightened Government of West Australia is issuing already two decades, pertaining to the leading timber-trees of the great western colony; and perhaps some of the other colonial Governments may follow this example, to expedite the work, and to relieve our own colony of a portion of the cost of a publication, in which all Australia

is not only scientifically but also technologically interested. The limits to be assigned to a work such as an Eucalyptography, supposed to serve industrial and forestral as well as scientific purposes, have been the subject of much meditation of the author. Practically there is no limit to a work of this kind, particularly when it is remembered, that the Eucalypts form the principal timber-vegetation nearly all over the wide Australian continent, and that for all ages the inhabitants of this portion of the globe will have to rely largely if not mainly on Eucalypts for wood-supply, not to speak of what other nations are doing and likely to do with our trees elsewhere. In adopting for the gradual appearance of this work an unconstrained issue, it becomes possible, to add to the text of any species, whenever in the progress of discoveries or of experiments new data may require to be recorded, by merely inserting additional independent pages or even plates. Through these remarks it may at once be explained, why in some instances fuller details on particular utilitarian qualities, possessed by some of the leading Eucalypts, are even reserved for a future period. To render records on the industrial value of any woods really reliable for timber-merchants or artisans or industrial exhibitors, any single experiments are of little avail; only from numerous tests even of the same kind of wood, obtained at different seasons and from distinct localities, can general conclusions be drawn as regards the specific properties of one sort of timber in comparison to the greater or lesser merits of others. For resuming such tests on an extensive scale, it is hoped, renewed facilities will early arise by the restoration of the laboratory-accommodation and requisite apparatus, all completely withdrawn from the Government Botanist's department, with many other indispensable auxiliaries, some years ago. The needful provision, established by the writer in former years, enabled him then also to commence to place the potash, oils, tars, acids, dyes, tans and other products and educts from Eucalypts before the industrial world at the universal exhibitions. For ascertaining the relative ratio of growth of the Eucalyptus-trees, their dependence on particular soils, their adaptability to various technologic purposes and many other objects of general interest, connected with this remarkable kind of vegetation, a scientific observer should also not be left aidless in withholding from his control an extensive collection of growing trees, such as the writer during twenty years had brought gradually together for his continual observations from almost all parts of Australia. Observant rural colonists as well as travellers in any portion of Australia could much advance a thorough knowledge of the Eucalypts by securing for the writer of these pages some leafy branchlets with flowerbuds, expanded flowers and ripe fruits of any species of Eucalyptus within their range of observation, accompanied whenever it can be done by notes on the geologic formation of the places of growth, the aboriginal vernacular, the height of the tree, the peculiarities of the bark and timber of each species, the time of flowering and such other data as may seem of interest.

In submitting now the first portion of this monography to the public, the author ventures to express a hope, that the importance of the Eucalypts, whether viewed in their often unparalleled celerity of growth among hardwood-trees, or estimated in their manifold applicabilities to the purposes of industrial life, or contemplated as representing among them in all-overtowering height the loftiest trees in Her Majesty's dominions, will be still more deservedly recognized by the perusal of these unpretensive pages both here and elsewhere.

Melbourne, Easter 1879.

Tod. del. C. Troedel & Cº Lith. F. v. M. direxit. Steam Litho Gov. Printing Office Melb.

Eucalyptus Abergiana. *F. v M.*

EUCALYPTUS ABERGIANA.

F. v. M., fragmenta phytographiæ Australiæ xi. 142 (1878).

Finally very tall; *leaves* scattered, of thick consistence, oval- or elongated-lanceolar, *hardly inequilateral, shining above, opaque beneath; the lateral veins copious subtle and very spreading,* the longitudinal vein almost contiguous to the margin of the leaves or but slightly removed from the edge; *panicles terminal;* flowerstalks thick, almost cylindrical, the ultimates bearing 2–6 flowers on exceedingly short or *without stalklets;* calyces pale, their tube truncate-ovate nearly twice as long as the almost hemispheric *lid,* not angular; stamens all or nearly all fertile, inflexed before expansion; anthers oval, with nearly longitudinal dehiscence; stigma very slightly dilated; *fruits large, oval-urnshaped,* smooth, with a thin margin and with four enclosed at first horizontal valves; *fertile seeds expanding from their summit into a long membrane,* much longer than the slender sterile seeds.

On the mountains near Rockingham-Bay; Dallachy.

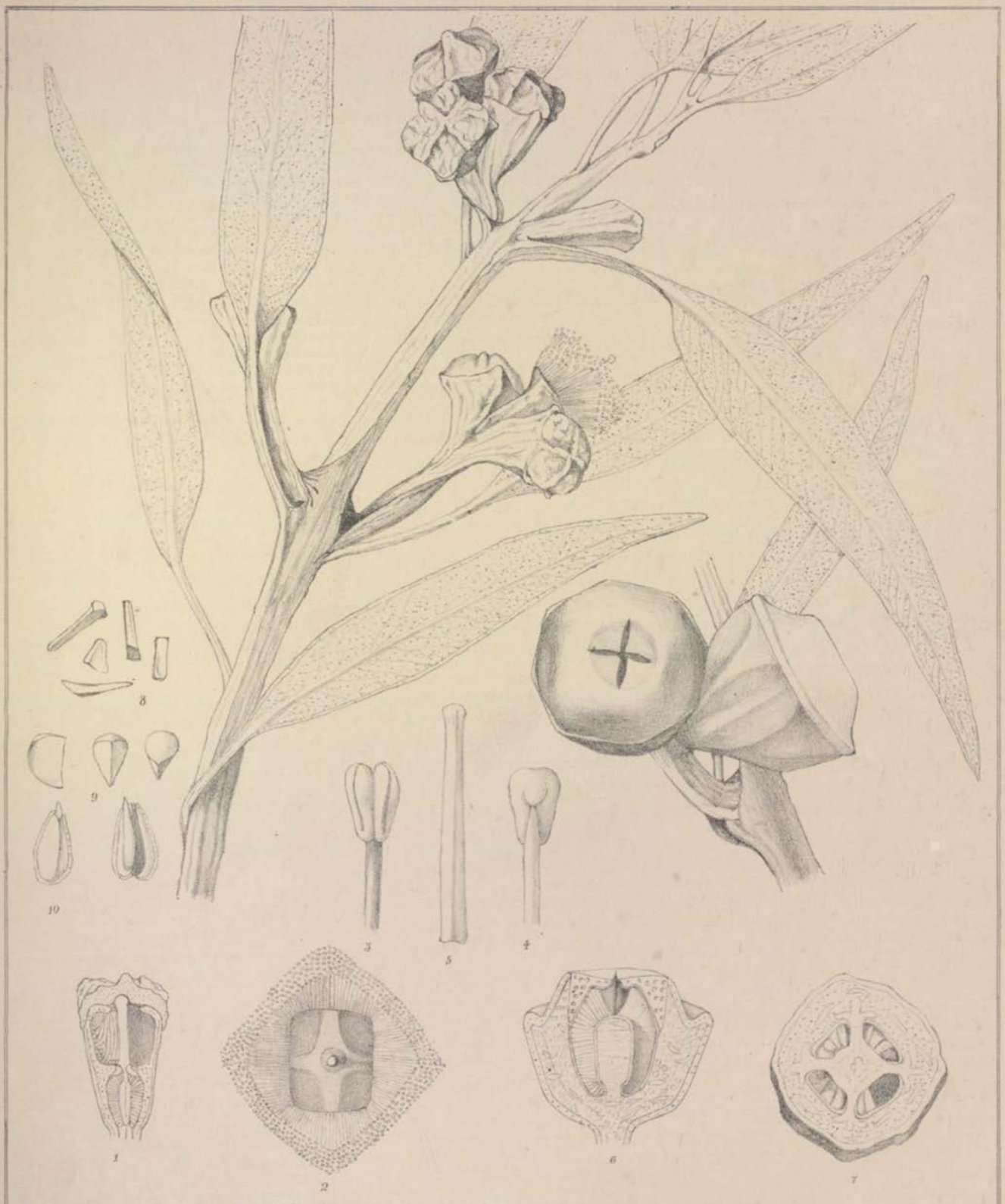
A lofty tree, with persistent bark and very expanding branches. Heart-wood very hard, reddish. Branchlets in some instances slender and somewhat angular, in other cases thick and cylindrical. Leafstalks ¾–1½ inches long. Leaves measuring 2½–4 inches in length or occasionally longer, rarely shortened to an almost oval form, 1–2 inches broad, often very gradually narrowed upwards, blunt at the base. Panicle almost corymbous; its ultimate flowerstalks generally about 1 inch long, as well as the branchlets pale, not shining. The unopened calyces eggshaped, their very blunt and rather thick lid rather separating by a horizontal rupture than by a well defined suture of circumcision; the tube in flowering state about ½ an inch long, sometimes subsequently slightly turbinate. A few of the outer stamens occasionally devoid of anthers; filaments according to the note of the collector whitish in a fresh state, but reddish-yellow when dry; the longer filaments 4–5 lines long. Anthers hardly ½ a line long; their cells separated by a broad connective. Style half included within the calyx, exceeded by the stamens. Fruit 1 inch long or somewhat longer, not angular; the valves deltoid-shaped, hardly ⅛ inch long. Fertile seeds very compressed, terminated by a semioval membrane, giving a length of about ⅓ inch for the whole seed including the appendage.

This stately species is dedicated to a Swedish physician, Ernest Aberg, M.D., Ch.M., who subjected in the La Plata States many Eucalypts to test-culture, and published a meritorious work on the importance of these trees for wood-supply in the Argentine Republic "Irrigacion y Eucalyptus," Buenos-Aires, 1874.

E. Abergiana approaches in its affinity to E. ptychocarpa (F. M., in the Journal of the Proceedings of the Linnean Society iii. 90), with which it agrees in the size and shape of its fruit, but the latter is in no way lined with prominent longitudinal ridges, nor are the flowers provided with conspicuous stalklets.—E. miniata differs in narrower leaves opaque on both sides, axillary solitary flowerstalks, longitudinally angular calyces, longer anthers, larger fruits and seeds without any appendage.—E. Watsoniana (F. M., fragm. phytogr. Austr. x. 98) again recedes in narrower leaves equally colored on either side, calyces with a varnish-lustre and fixed to distinct stalklets, a widely dilated lid, which overreaches the orifice of the calyx-tube, longer stamens, fruits wider at the summit with a furrowed broader rim and unappendiculated seeds.—E. corymbosa, which likewise occurs as far north as Rockingham-Bay, is separated by its narrower leaves acute at the base, angular and more slender flowerstalks, smaller calyces provided with stalklets and not pale-colored, a thinner and not obtuse lid, which separates by a distinct suture of the

calyx, smaller fruits more contracted upwards and the lesser appendage of the seeds.—E. terminalis (F. M., in Journ. of Proceed. of the Linnean Society iii. 89) is distinguished in a similar manner from E. Abergiana as E. corymbosa, except the seeds, but besides in the paler foliage, the leaves being of equal color on both sides, necessitating stomata on each and not merely on the underside as in E. Abergiana; thus also the latter, like all the species with only hypogenous stomata, forms a more shady tree, its leaves expanding more horizontally, whereas E. terminalis like the majority of its congeners turns its leaves more vertically.

Explanation of Analytic Details.—1, longitudinal section of unexpanded flower; 2, back-, front- and side-view of a stamen; 3, style and stigma; 4 and 5, transverse and longitudinal section of fruit; 6 and 7, fertile and sterile seeds; 8, portion of a leaf; all moderately but variously magnified.



R. Austen delt et Lith. Baron von Mueller direxit. C. Troedel & Co. imp.

Eucalyptus erythrocorys. *F.v.M.*

EUCALYPTUS ERYTHROCORYS. 2

F. v. M., fragmenta phytographiæ Australiæ ii. 33 (1860); Bentham, flora Australiensis iii. 258.

Shrubby or finally arborescent; branchlets robust, angular; *leaves opposite* or some scattered, elongate-lanceolar, slightly curved, their lateral vein moderately spreading, copious and prominent, the intramarginal vein slightly removed from the edge; stalks axillary, thick, compressed-angular, bearing one to three flowers; stalklets hardly any; *calyces large, their tube obverse-pyramidal and quadrangular* as well as marked with prominent irregular longitudinal lines or furrows, produced into four blunt teeth; *lid red, very depressed*, lined by four prominent ridges in the form of a cross, wrinkled, considerably shorter than the tube of the calyx and often slightly broader; *stamens yellow, forming four parcels;* anthers cordate-oval, opening by longitudinal slits; stigma hardly broader than the style; *fruit very large*, bellshaped-hemispherical, 4-celled, at the margined summit first ascending then flat and at the deltoid red valves impressed; placental axis about twice as long as broad; sterile seeds partly narrow; fertile seeds without any membranous appendage.

In stony undulating bushy country between the Irwin-River and Shark-Bay, rather rare.

Quite an ornamental bush, bearing as even remarkable to the aborigines the name "Illyarie." Leaves shining, equally green on both pages, 3½–7 inches long, in their widest portion ⅔–1 inch broad, very gradually narrowed into the acute apex. Flowerstalks attaining seldom above one inch in length, sometimes shorter. Whole calyx nearly an inch in length; lid almost twice as broad as high, sometimes raised into a short knob at the centre. Bundles of stamens emerging from four protruding lobes of the disk. Filaments sometimes purplish. Fruit measuring from nearly 1¼ to 2 inches, with 12 longitudinal angular elevations, these ternately convergent at the summit; valves rather shorter than the convex interstice between them and the margin of the calyx. Fertile seeds much broader than most of the sterile seeds. Flowers and fruits occur of greater size than those delineated on this occasion.

This species, on account of the stamens united into four bundles alternating with the four teeth of the calyx, belongs to the section Eudesmia, which R. Brown regarded as a distinct genus.

It differs widely from the few other species of that section in the large size of its flowers and fruits, in the shape and coloration of the lid as well as in the very broad expansion of the summit of its fruit, irrespective of some less conspicuous differences.

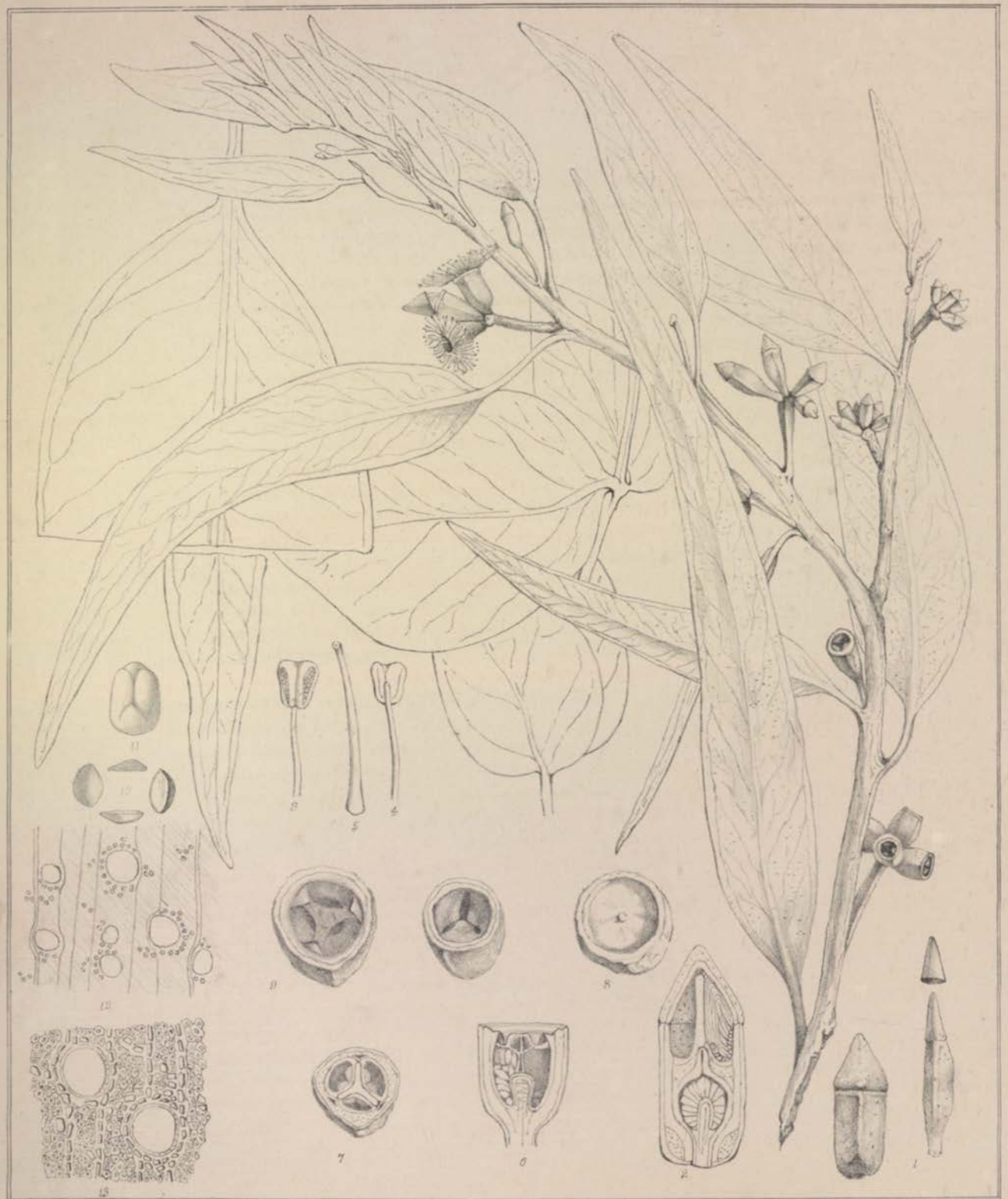
Specific name from the red tinge of the operculum.

Explanation of Analytic Details.—1, longitudinal section of unexpanded flower; 2, expanded flowers seen from above; 3 and 4, front- and back-view of anther; 5, style with stigma; 6, longitudinal section of fruit; 7, transverse section of fruit; 8, sterile seeds; 9, fertile seeds; 10, embryo.

It may be of some interest to observe, that though the pollen-grains of all Eucalypts hitherto thus far examined are when moistened uniformly tetrahedral and smooth, they differ considerably as regards size in various species. The annexed series of measurements, elaborated under my direction by Mr. Rummel, proves already, that the pollen-grains of some Eucalypts may exceed those of others nearly thrice in diametric width, and still greater discrepancies may exist within the genus; such may perhaps aid occasionally in the discrimination of different species. How far such measurements may fluctuate in the same species needs yet further to be traced out, but it is not likely to vary much in each particular kind of Eucalypt.

Measurement of Pollen-grains of Eucalypts.

Eucalyptus calophylla	= ·00130 inch	= ·0330 millimeter
ficifolia	= ·00130 inch	
Doratoxylon	= ·00115 inch	= ·0292 millimeter
erythrocorys	= ·00115 inch	
Preissiana	= ·00105 inch	= ·0268 millimeter
Watsoniana	= ·00105 inch	
miniata	= ·00105 inch	
macrocarpa	= ·00105 inch	
conoidea	= ·00105 inch	
perfoliata	= ·00105 inch	
salubris	= ·00105 inch	
tetraptera	= ·00105 inch	
concolor	= ·00105 inch	
Lehmanni	= ·00105 inch	
cornuta	= ·00105 inch	
occidentalis	= ·00100 inch	= ·0254 millimeter
grossa	= ·00100 inch	
pachyloma	= ·00090 inch	= ·0229 millimeter
rudis	= ·00090 inch	
pyriformis	= ·00090 inch	
longifolia	= ·00090 inch	
diversicolor	= ·00090 inch	
botryoides	= ·00090 inch	
gomphocephala	= ·00090 inch	
Eucalyptus micranthera	= ·00090 inch	
goniantha	= ·00090 inch	
dumosa	= ·00090 inch	
decurva	= ·00090 inch	
buprestium	= ·00080 inch	= ·0203 millimeter
marginata	= ·00080 inch	
macrandra	= ·00080 inch	
robusta	= ·00080 inch	
pellita	= ·00080 inch	
resinifera	= ·00080 inch	
reduncа	= ·00080 inch	
incrassata	= ·00080 inch	
decipiens	= ·00080 inch	
tetragona	= ·00070 inch	= ·0178 millimeter
saligna	= ·00070 inch	
goniocalyx	= ·00070 inch	
uncinata	= ·00070 inch	
loxophleba	= ·00070 inch	
salmonophloia	= ·00070 inch	
fœcunda	= ·00070 inch	
patens	= ·00070 inch	
Drummondi	= ·00070 inch	
Cloëziana	= ·00060 inch	= ·0152 millimeter
endesmioides	= ·00050 inch	= ·0128 millimeter



B.Austen del & Lith. Baron von Mueller direxit. C.Troedel & C.ie imp.

Eucalyptus goniocalyx. *FvM*

EUCALYPTUS GONIOCALYX. 3

F. v. M., in Nederlandisk Kruitkundig Archiev iv. 134 (1859); Fragmenta phytographiæ Australiæ ii. 48; Bentham, flora Australiensis iii. 229; E. elæophora, F. v. M. l. c. iv. 52.

The Spotted Gum-tree of Victoria. Finally very tall; leaves scattered, elongate- or sickle-shaped-lanceolar, rarely verging into a more oval form, of equal color on both sides, rather opaque or not strongly shining; oil-pores much concealed or transparent; veins thin, moderately spreading, the intramarginal vein somewhat removed from the edge; *flowerstalks broadly compressed*, axillary, solitary, exceptionally panicled, bearing 4–7 seldom fewer flowers; *calyces without or on very short stalklets, conspicuously angular; lid pyramidal- or conical-hemispheric*, about half as long as the obconical- or oval-cylindrical tube, or rarely the lid fully as long as the tube or occasionally even three times shorter; stamens all fertile, inflexed while unexpanded; anthers almost oval, upwards slightly dilated and at the summit truncated, opening with longitudinal slits; stigma not broader than the apex of the style; *fruits truncate- or semi-ovate*, 3- or less frequently 4-*celled*, lined by 2–4 more or less prominent angles; valves deltoid, inserted very near the narrow margin of the orifice, enclosed or less often semi-exserted; seeds without any appendage, the sterile mostly narrower than the fertile seeds.

In low or hilly woodlands up to about 3,000 feet, intermixed with other Eucalypts, scattered from the vicinity of Portland-Bay and from the Wimmera, Pyrenees, the Upper Avoca and Loddon eastward, extending thus to the Gellibrand- Ovens- and Hume-Rivers, advancing south to Cape Otway and Wilson's Promontory, through Gippsland to Twofold Bay and also into New South Wales as far as Braidwood, in the latter locality noted by Mr. Wilkinson, and there in granite-country.

This tree attains in rich forest-valleys a height of 300 feet (Falck, Walter), with a stem-diameter not altogether rarely up to 6 feet, exceptionally even of 10 feet (Boyle); but where it is of much lower growth the stem (according to Mr. G. W. Robinson) may branch out from comparatively near the ground. As regards the nature of the bark it fluctuates between Hemiphloiæ and Leiophloiæ; in the latter case the tree passes among the woodmen as Blue and White Gum-tree, in the other case as Grey or Bastard Box. Local colonists have bestowed many other perplexing vernacular names on this species of tree, and thus in East Gippsland it is the Mountain-Ash. The bark where persistent on the stem is thick, but not fibrous. The above quoted synonym pertains to the variety with more persistent bark.

The wood is hard and tough, usually free from kino-veins, varies from a pale-yellowish to a brownish color, is exceedingly durable and also lasting long underground, not warping and on account of the interwoven woody fibres almost as difficult to split as that of E. rostrata. It is much esteemed by wheelwrights, particularly for spokes (Falck), in ship- and boat-building, for railway-ties; when not eligible for better purposes it is sought for good fuel. According to Mr. Boyle the rough-barked variety from low dry and stony ranges supplies a timber, which wheelwrights consider equal to Ironbark, with the advantage of its not being so weighty; the taller mountain-variety with smoother bark is more used for planks, piles and general building purposes, the timber also in this instance being more durable, than that from wet forest-valleys, such as the Musk-tree gullies of Gippsland, to which this species descends, also attaining there a height of 300 feet on the testimony of Mr. Howitt. The average width of the vascular tubes is 0·12 mm.; their walls are thin, and parenchyma-cells often approach them; the woody fibres are somewhat flattened, moderately thickened and up to 0·02 mm. broad. The medullary rays are

very numerous, consisting of one or two rows of short cells. I find this in accordance with observations by Dr. Josef Moeller.

The leaves on young plants and on adventitious shoots exceed sometimes a foot in length. Young seedlings have heartshaped- or oval-roundish opposite sessile leaves, often much paler beneath than above, but their stem is not quadrangular. In rare instances the stalklets of the flowers become somewhat elongated. I found the lid sometimes double, the outer one being fugacious. The fruit occurs not rarely of double the size of that delineated on the plate. A pair of connate bracts covers cap-like the very young flower-cluster. The specific name was derived from the particularly angular calyx.

E. goniocalyx differs from E. albens (Miquel, in Nederl. Kruitk. Archiev iv. 138) in less persistent darker more deeply wrinkled or fissurated bark, the not usually pale hue of the foliage, mostly narrower leaves with thinner and less spreading veins, very compressed flowerstalks, umbels only exceptionally not all solitary, shorter and rather less pointed lid, somewhat larger and not almost globular anthers with longer slits, more angular fruit not almost always 4-celled, nor the valves so deeply inserted.

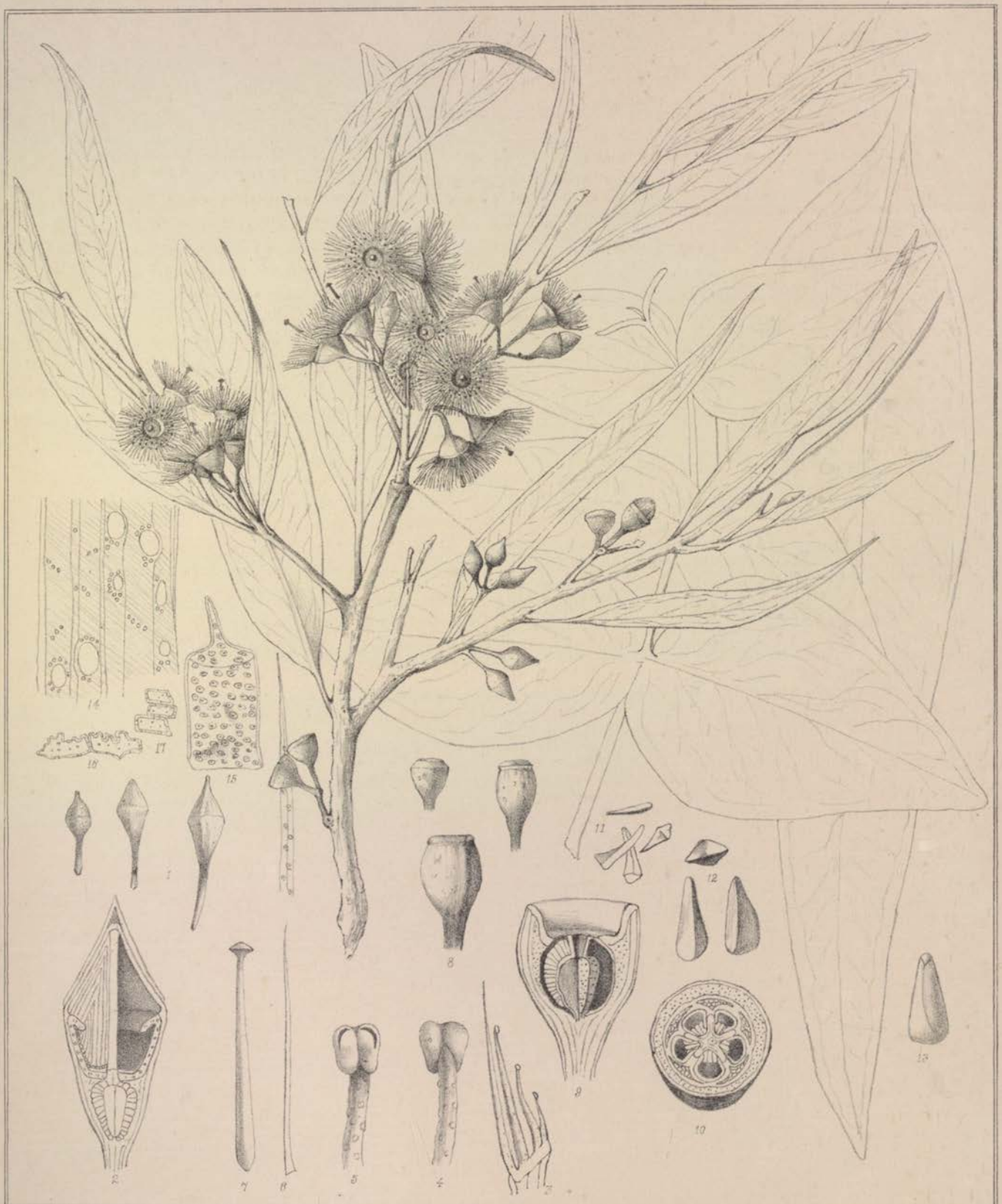
It is separated from E. viminalis in the veins of the leaves less crowded and less divergent, in strongly compressed stalks with usually more than three flowers, in the angular calyx with upwards more gradually attenuated lid, longer tube of the calyx, the more elongated fruit not extended into an emerging broad rim, valves not usually four in number nor as a rule fully exserted.

From E. capitellata it recedes in its bark not being very fibrous, in usually less shining foliage, leaves with finer veins, distinctly angular calyx, anthers rather obverse- than renate-heartshaped, thus upwards but not downwards dilated, fruit-calyx more elongated and usually narrower with a neither protruding nor convex rim, so that the valves cannot rise from the vertex.

From E. botryoides it is discernible by its less extensively persistent bark, by leaves not darker green above than beneath, with less numerous and less transverse veins and with a different distribution of the stomata and by a more gradually acute lid, but it bears close resemblance to E. botryoides in its head-like umbels on flat two-edged stalks and likewise much in the form as well as in the structure of the fruit, though the valves are not so often four and perhaps never five in number and generally nearer the summit.

This is one of the most deserving of Eucalypts for forest-culture.

Explanation of Analytic Details.—1, unexpanded calyx in two forms, outer lid of one detached; 2, longitudinal section of flowerbud; 3 and 4, front- and back-view of a stamen; 5, style with stigma; 6, longitudinal section of fruit; 7 and 9, transverse section of young and old fruit; 8, young fruit seen from above; 10, seeds; 11, embryo; 12 and 13, transverse section of wood; the two latter respectively 60 and 220 times magnified; the other figures very moderately but variously enlarged.



F.Austen del.et Lith. F.von Mueller direxit C.Troedel & Co. imp

Eucalyptus Leucoxylon. *FvM*

EUCALYPTUS LEUCOXYLON. 4

F. v. M., in the Transactions of the Victorian Institute i. 33 (1854); Miquel, in Nederlandisk Kruitkundig Archiev iv. 126 (1859); F. v. M., fragmenta phytographiæ Australiæ ii. 60 (1860); Bentham, flora Australiensis iii. 210 (1866).

The Victorian Ironbark-tree. Finally tall; leaves scattered, narrow-lanceolar and somewhat sickleshaped, rarely oblong-lanceolar, of equal either greyish- or dull-green on both sides, not usually shining, on moderately long or rather short stalks, their veins neither very spreading nor very numerous, the marginal vein distinctly removed from the edge; pellucid oil-dots rather copious; *flowers on each axillary or lateral stalk usually three* or sometimes 4–5, rarely 6–11, the umbels occasionally slightly paniculate; calyx on a slender stalklet, wrinkled by exsiccation, its tube semiovate or broadly obverse-conical, about as long as the *gradually short-pointed lid; outer stamens destitute of anthers*; filaments pale-yellow, rarely pink, rather thick and somewhat glandular; anthers very minute, nearly as broad as long, upwards dilated, opening towards the summit with short slits; style comparatively long; *stigma dilated;* fruit semiovate, 4–7-celled, not or very rarely angular; rim strongly compressed or seldom slightly flat; valves short, quite enclosed; fertile seeds finely net-veined, as well as the much narrower sterile seeds usually very small and without any expanding membrane.

Dispersed from South-Queensland through New South Wales to many parts of our colony and thence westward to Spencer's Gulf.

This is the Ironbark-tree of Victoria and many districts of New South Wales, but also the White Gum-tree of South Australia, where already in 1847 I bestowed the specific name on this Eucalypt in contradistinction to the Red Gum-tree, with which it is associated on the alluvial plains around Adelaide. Two forms of this species bear marked outward differences, arising from geologic circumstances. The variety designated White Gum-tree, has the greater portion of the stem pale and smooth through the outer layers of the bark seceding. The variety, known as our Ironbark-tree and mostly occurring on stony ridges or mountains of the lower silurian sandstone- and slate-formation, retains the whole bark on the stem, it thus becoming deeply fissured and furrowed, very hard and dark-colored.

The manuscript name E. Sideroxylon, given by Allan Cunningham to this species, is merely incidentally and without description mentioned in Sir Thomas Mitchell's "Tropical Australia," p. 339 (1848), and would imply, that the vernacular name of this tree was Ironwood, an appellation nowhere in use. The flowers and fruits are sometimes considerably larger than those delineated on the present illustration, but occasionally even smaller. The tree attains usually only a moderate size, but occasionally advances to a height of 200 feet. I have however seen this species flowering already in a shrubby state, even when the leaves were still opposite.

Its nearest affinity is to Eucalyptus melliodora, of which some illustrations can be compared in my works on the "Plants Indigenous to the Colony of Victoria," suppl. pl. xvii., and "Introduction to Botanic Teachings at the Schools of Victoria," fig. vii. The flowers of E. melliodora are however often somewhat paniculate and are as well as the leaves and fruits evidently smaller, and the lid is less pointed, while the bark never secedes so much as to leave the stem smooth and pale.

The leaves of the young seedlings of E. Leucoxylon are cordate- or lanceolar-ovate, opposite, sessile and smooth.

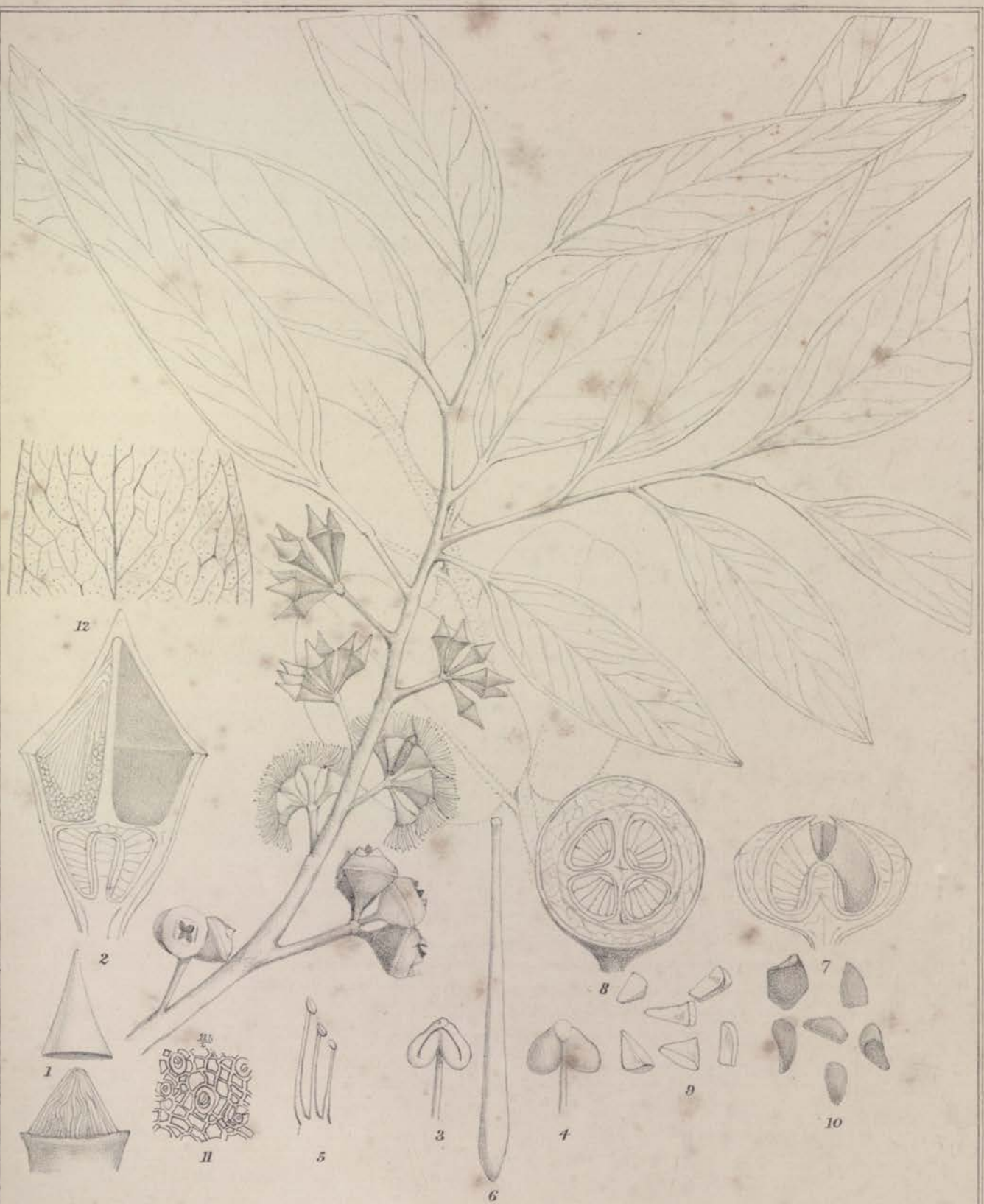
It is one of the best among Eucalypts for a moist tropical clime. Here in our colony the rugged-barked variety is often indicative of a gold-bearing country. Mr. A. W. Howitt has

ascertained, that the Ironbark-tree bears among the Gippsland aboriginal tribes the name of "Yerrick." The nectar-juice of the flowers very much attracts bees.

The vascular tubes of the wood are irregularly dispersed and contain some cellular substances; their walls are dotted. The parenchymatous cells are scanty and near the tubes; the woody fibres are also dotted and in transverse section circular with an exceedingly narrowed hollowness; the medullary rays are disposed in simple or double or rarely triple rows of elongated cells with extremely thin walls. This accords with observations first instituted by Dr. J. Möller. The timber is of great hardness, durability and extraordinary strength, not usually fissile; it varies in color from a pale hue to light shades of reddish-brown. It is used for wheel-work, particularly cogs, also shafts, poles, railway-sleepers, the stocks of rudders, treenails and topsides in ship-building, also extensively for lining the shafts of mines, further for various implements, which need a tough wood, such as axe-handles, &c. The specific gravity of air-dried wood varies from 1·140 to 1·024, equal to from 71–63½ lbs. of weight for a cubic foot, but still more variable according to the age and the situation of the tree yielding the timber, yet always heavier than water. Builders call it close- and straight-grained and slightly greasy. In my laboratory the wood yielded 28 per cent. of superior charcoal, 45 per cent. of crude wood-vinegar and 6 per cent. of tar, which products are of course also obtainable from every other kind of Eucalyptus, as well as from any other timber, though in somewhat variable quantity and quality. I have long since shown that packing-paper can be prepared from the inner layers of the bark, like from all congeners. The yield of volatile oil from the leaves exceeds as a rule slightly 1 per cent. Our Ironbark-tree is comparatively rich in Kino, valuable as a therapeutic astringent, as much as 22 per cent. having been obtained from fresh bark in my laboratory; the tannic acid of Eucalyptus Kino is however not equal to that of the Oak and Acacia-Wattles in tan-power, but can be used as subsidiary in tanning process, when light-colored leather is not an object. This Kino from our Ironbark-tree is easily soluble in water, of slightly acid reaction, becomes turbid but clear again on heating.

Some of the above notes on the timber are taken from the jurors' reports of our Industrial Exhibition of 1862, which recently have also been utilized again for a publication of the Technologic Museum of Melbourne.

EXPLANATION OF ANALYTIC DETAILS.—1, various sizes of unexpanded calyces; 2, longitudinal section of flowerbud; 3, sterile and fertile stamens; 4 and 5, front- and back-view of fertile stamens; 6, a sterile stamen; 7, style and stigma; 8, fruits of various size; 9, longitudinal section of fruit; 10, transverse section of fruit; 11, sterile seeds; 12, fertile seeds; 13, embryo; 14, transverse section of wood; 15, a separate vascular tube and next to it an isolated woody fibre; 16, parenchymatous particles. 1 and 8 natural size; 2, 3, 6, 7, 9, 10 somewhat enlarged; 4, 5, 11, 12, 13 much enlarged; 14 to 17 magnified 220 times diametrically.



H.Austen del. et lith.

F. v M. direxit.

Steam Litho. Gov Printing Office Melb

Eucalyptus macrorrhyncha. *F.v.M.*

F. v. M., First General Report, p. 12 (1853); Bentham flora Australiensis iii. 207 (1866); F. v. M., fragmenta phytographiæ Australiæ xi. 45 (1878).

The ordinary Stringybark-tree of Victoria.

Finally tall; leaves scattered, elongate- or sickleshaped-lanceolar, rarely verging into an almost oval form, equally green on both sides, with very subtle much concealed oil-dots; their lateral veins moderately spreading, the intramarginal vein distinctly removed from the edge; umbels solitary or slightly paniculate, on cylindrical on somewhat angular stalks, bearing from 4–9 flowers; *tube of the calyx tapering into a conspicuous stalklet, obconic-hemispherical; lid from a dilated base sharply and concavely attenuated into a short awlshaped often curved apex* or sometimes almost conical towards the summit, about as long as or somewhat longer than the tube, neither of them longitudinally angular, but at their junction mostly forming a prominent transverse sutural line; stamens all fertile, inflexed while unexpanded; *anthers cordate-kidneyshaped;* stigma not broader than the apex of the style; *fruit-calyx almost hemispherical, not much longer than the amply protruding very convex vertex; valves wholly exserted,* 3 or less frequently 4 in number, shorter than the broad rim; the sterile seeds not very narrow, all without appendage.

On comparatively sterile ridges and ranges, chiefly of the silurian-formation, widely and often gregariously distributed through much of the wooded country of Victoria, for instances towards the Upper Yarra and in the Dandenong-Ranges; thence to the mountains of Gippsland easterly, to the Mitta-Mitta and Hume-River northerly, the Avoca and the Pyrenees westerly and towards Cape Otway southerly in our colony, but reaching also the western slopes of the main coast-ranges of New South Wales.

Both this species and E. capitellata pass as "Yangoora" among the aborigines of Gippsland, according to Mr. Howitt's annotation.

This Stringybark-tree cannot rival in height with E. obliqua (our Messmate-tree and the ordinary Stringybark-tree of South Australia and Tasmania), nor does it generally ascend the mountains to the high elevations reached by E. obliqua, although both species occur often intermingled. The wood is hard and mostly tinged with a deeper red-brownish coloration, but occurs also pale-colored; it is durable and easily fissile into fence-rails, shingles, palings and very useful for all purposes, for which rough split timber is required above ground; it is also sawn into weatherboards and scantling and furnishes as well a fair fuel. The thick fibrous bark, which is persistent as well on the branches as on the stem, when removed in large sheets and levelled and dried under some pressure, is extensively used for roofing primitive huts, sheds and stables in districts where the tree occurs; for this purpose it will last about twenty years. The bark outside is of a squalid or dark-grey color, deeply fissured by longitudinal or somewhat oblique furrows, reminding of that of the Ironbark-tree; the inner layers are so tough as to become available for rough tying; it is less fibrous and fragile, but more solid and more deeply furrowed, than that of E. obliqua.

The specific gravity of the seasoned wood is about 1·020 or 63½ lbs. for the cubic foot. The stems of the seedlings have a peculiar roughness from warty glands beset with minute tufts of hair, not observable in the generality of the Victorian Eucalypts except E. capitellata; but for extensive observations on these characteristics I have since years not enjoyed any facilities in cultural ground and appliances; the leaves of young seedlings are opposite or soon some scattered, short-stalked or sessile, from cordate-ovate to finally lanceolar. A variety occurs with fruits on very short or even without stalklets and of lesser size than those delineated.

In specific botanical affinity E. macrorrhyncha stands nearest to E. capitellata; leaves and fruits of both are the same; but the flowers of the latter are always sessile or nearly so and thus crowded into heads as the species-name signifies, besides being usually smaller; the lid of E. capitellata is hemispheric, without any prominent point and shorter in proportion to the tube, the latter being also more angular and downward less attenuated.

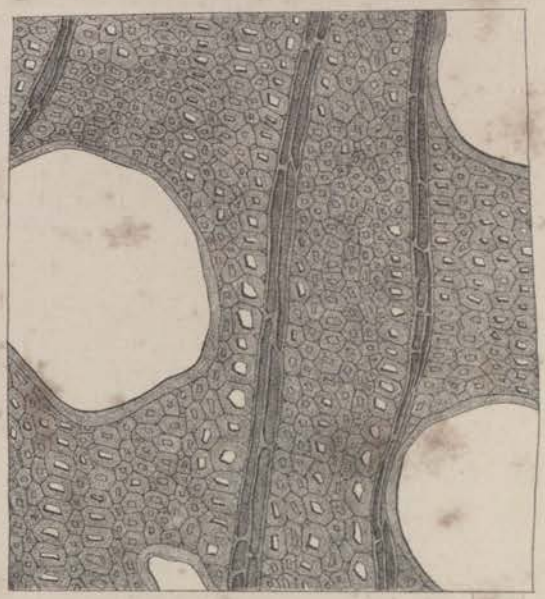
E. santalifolia (F. v. M., in the Transactions of the Victorian Institute i. 35) from the limestone-ridges of Guichen-Bay and thence westward to Venus-Bay beyond Spencer's Gulf, differs in smaller and less oblique leaves with more concealed veins and anthers rather cordate than kidneyshaped, but the fruits are again the same, unless the valves are smaller. Possibly it may prove a variety; it flowers already in a shrubby state. I have not seen the lid of its calyx.

The variety brachycorys, mentioned by Bentham, seems transferable to E. capitellata, unless indeed it should prove distinct from both, when as a species it could be kept apart under the above designation.

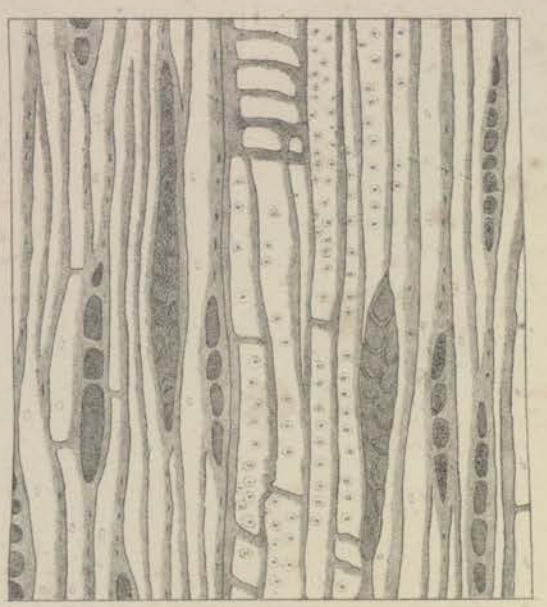
Explanation of Analytic Details.—1, summit of calyx, the lid detached; 2, longitudinal section of an unexpanded flower; 3 and 4, front- and back-view of an anther; 5, three stamens in situ, all fertile; 6, style with its stigma; 7 and 8, longitudinal and transverse section of fruit; 9 and 10, sterile and fertile seeds; 11, epidermis, showing its cells and stomata, diametrically 125 times magnified; 12, portion of a leaf to exhibit the venation and oil-glands; all figures except 11, only moderately magnified, the ratio of augmentation easily perceived by comparison of the main figure, which in all plates of this Atlas represents natural size.

Anatomic Plate.—1, cellular cuticle of the leaf, showing also the breathing pores or stomates; 2, transverse section of aged wood, the large openings representing the vascular tubes; the rows of elongated cells constitute the medullary rays; the scattered cells and those near the vascular tubes are parenchyme; the rest show the transverse form of the numerous woody fibres, all closely set and in diameter smaller than the parenchyme-cells; 3, tangential section of aged wood; wide and dotted vascular tubes, rows of cells of the medullary rays cut transversely, sparingly dotted woody fibres, parenchymatous ampler interstices; 4, radial section of aged wood, wide dotted vascular tubes, rows of cells of the medullary rays cut vertically, sparingly dotted woody fibres, parenchymatous ampler interstices; all magnified 214 times diametrically.

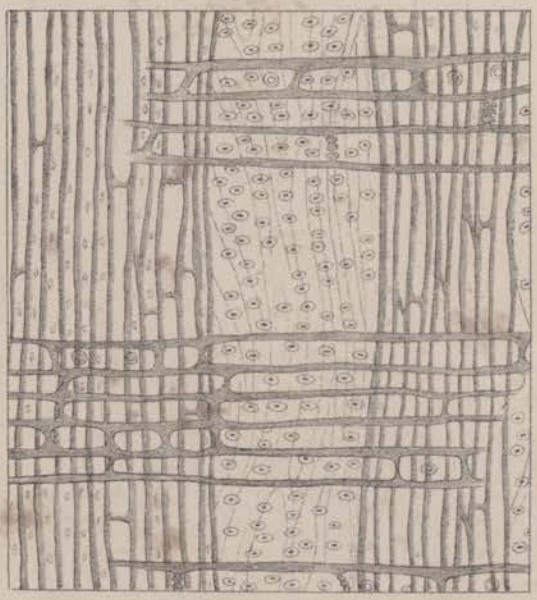
2



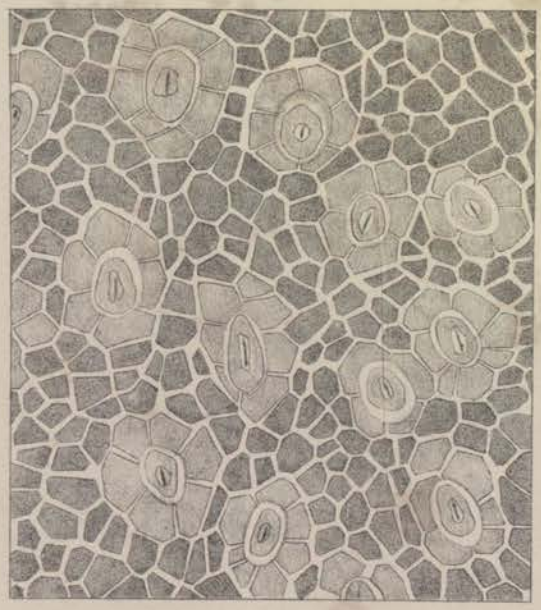
3



4



1

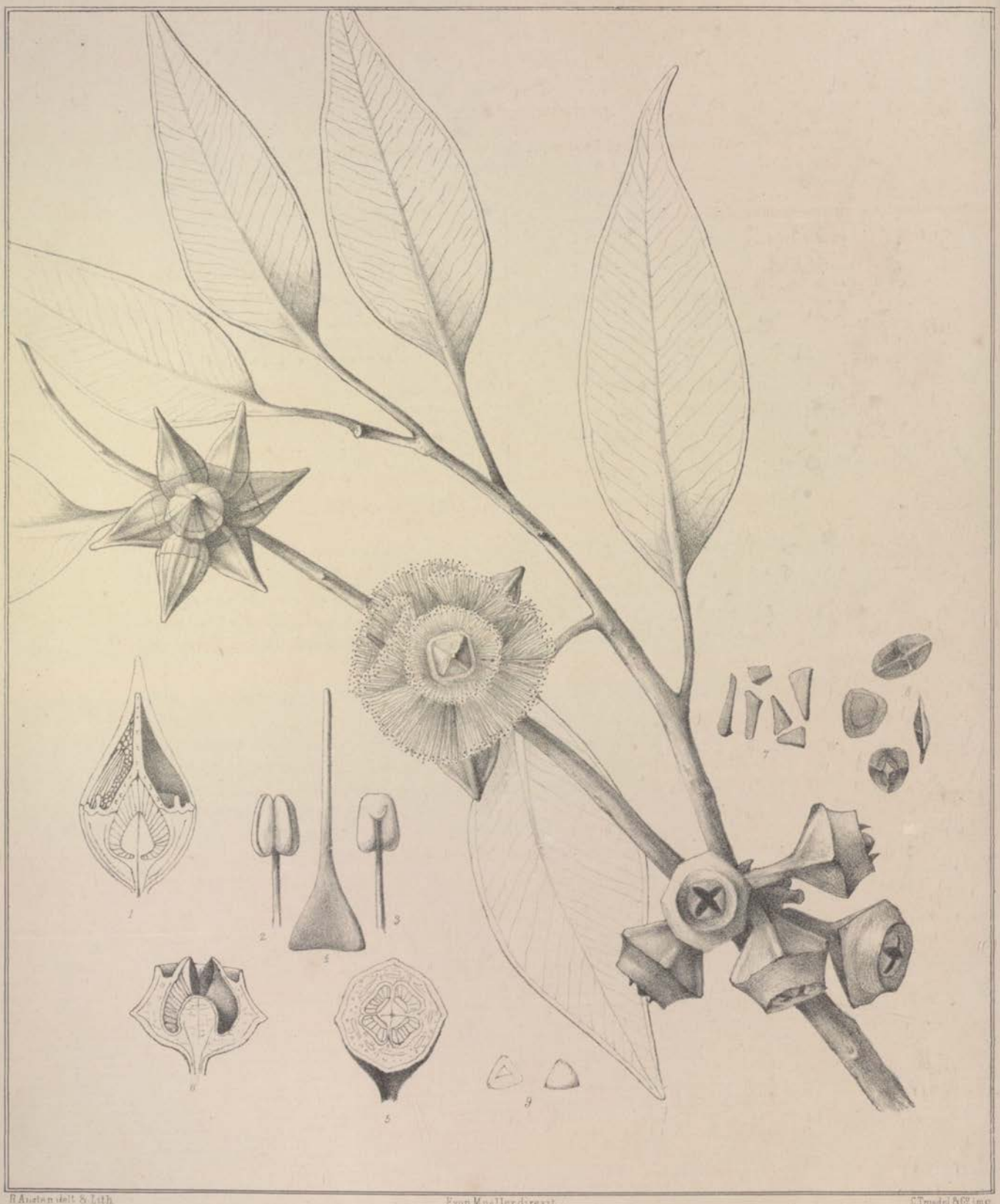


L. Rummel del.

Baron von Mueller direxit.

Steam Litho. Gov. Printing Office Melb.

Eucalyptus macrorrhyncha. *F.v.M.*



F.Austen delt & Lith. Ferd. von Mueller dir. ext. C.Troedel & Co.ª imp.

Eucalyptus pachyphylla. *F.v.M.*

EUCALYPTUS PACHYPHYLLA. 6

F. v. M., in the Journal of the Linnean Society 1859, pp. 83, 98 and 101; Bentham, flora Australiensis iii. 237 (1866); F. v. M., fragmenta phytographiæ Australiæ x. 5 (1876).

Shrubby; branchlets robust, not very angular; *leaves* scattered, on long stalks, of thick leathery consistence, ovate- or *broad-lanceolar, hardly unequal-sided,* very finely veined, not conspicuously dotted, the marginal vein distinctly removed from the edge; stalk very short, bearing several flowers either sessile or on short stalklets; *calyx with* 4–7 *longitudinal angles; the lid semiovate and acuminate,* twice as long as the tube; stamens yellow, inflected before expansion, with almost ovate anthers, their cells opening with longitudinal slits; style elongated; stigma not dilated; *fruit depressed-hemispherical, usually with* 4 *prominent angles, with a broad ascending rim* and 4 or 5 rarely 3 slightly exserted valves; placental axis nearly as broad as long; sterile seeds slender; *fertile seeds surrounded by a narrow membrane.*

In the deserts of Central Australia, known from Sturt's and Hooker's Creek to Lake Amadeus and MacDonnell's Range (F. M.; E. Giles).

The peculiar shape of the fruit distinguishes this species already from any other. The plant has merits for decorative culture in shrubberies and will bear the hottest drought. The heat, which this and other Central-Australian plants will endure, may exceptionally rise in the shade to 122° F., and in the sun to 164° F., or even as observed by McKinlay to 168° F. in the sun, and as noted by Sturt to 132° F. in the shade. This extraordinary endurance of heat, shown by some Eucalypts, finds to some extent its explanation in the great power of exhalation possessed by these plants.

Explanation of Analytic Details.—1, longitudinal section of an unexpanded flower; 2, front-view of an anther with the upper part of its filament; 3, back-view of the same; 4, pistil; 5, transverse section of young fruit; 6, longitudinal section of fruit; 7, sterile seeds; 8, fertile seeds; 9, pollen-grains, these diametrically 300 times magnified. The augmentation of the other details readily rated by comparison of the main figure, which is of natural size.

The Stomata or breathing-pores of the epidermis of leaves occur in about equal number on both pages in E. pachyphylla as in the majority of cases in Eucalypts, numbering in this instance about 40,000 to each square inch. This seems an apt opportunity to adduce the results, which by microscopic observations and micrometric measurements have been obtained concerning the number and distribution of the stomata in different species of this very large genus. As in Proteaceæ so in Eucalypteæ the occurrence of the stomata, whether on the underside of the leaves alone, or on both pages in unequal or in equal numbers, indicates three series, according to which the species have been tabulated below. In the time-absorbing elaboration of these details I have been aided by Mr. L. Rummel.

Table of Approximate Number of Stomata per Square Inch of Eucalyptus Leaves.

I.—*Stomata hypogenous* = on the underside only.

Eucalyptus Abergiana	...	180,000–228,000	Eucalyptus ficifolia	...	140,000–161,000
acmenoides	...	149,000–210,000	microcorys	...	210,000–211,000
botryoides	...	105,000–116,000	pellita	...	150,000–155,000
brachyandra	...	... 224,000	ptychocarpa	...	... 240,000
calophylla	...	207,000–230,000	resinifera	...	139,000–160,000
Cloëziana	...	310,000–311,000	robusta	...	155,000–195,000
corymbosa	...	100,000–157,000	Raveretiana	...	220,000–248,000
Decaisneana	...	... 207,000	saligna	...	155,000–217,000
diversicolor	...	170,000–228,000	trachyphloia	...	... 124,000

II.—*Stomata heterogenous* = on both sides, but less above than below.

Eucalyptus alpina	45,000 60,000
Baileyana	68,000 104,000
capitellata	20,000–45,000 50,000–62,000
citriodora	99,000–116,000 132,000–145,000
decipiens	50,000–52,000 90,000–97,000
globulus (leaves of aged plants)	35,000–39,000 45,000–56,000
globulus (leaves of young plant)	45,000 85,000
gomphocephala ...	89,000–99,000 178,000–199,000
grossa	23,000–39,000 37,000–60,000
macrandra	99,000–104,000 155,000–157,000
miniata	37,000–45,000 60,000–77,000
Eucalyptus obliqua	50,000–56,000 68,000–87,000
patens	54,000–60,000 120,000–124,000
pilularis	25,000–41,000 100,000–153,000
piperita	45,000–91,000 110,000–197,000
pyrophora	75,000–106,000 99,000–139,000
rigida	25,000–43,000 45,000–60,000
rudis	77,000–112,000 153,000–157,000
siderophloia	70,000–99,000 116,000–186,000
tesselaris	116,000–145,000 153,000–166,000
Torelliana	46,000–110,000 300,000–331,000
vernicosa	23,000–25,000 46,000–55,000

[For the continuation of this table see E. phœnicea.]

These data are in nearly all cases the results only of two experiments, on which other observers may enlarge by carrying on such researches.

In several instances exceptions seem to occur regarding this classification of the Eucalypts according to the distribution of their stomata; these apparent anomalies, concerning E. amygdalina, E. marginata, E. paniculata, E. terminalis and a few others, will become the subject of future elucidations.

R.Austen del. C.Troedel & C° Lith. F. v. M. direxit. Steam Lithe Gov. Printing Office, Melb.

Eucalyptus phoenicea. *F.v.M.*

EUCALYPTUS PHŒNICEA. 7

F. v. M., in the Journal of the Proceedings of the Linnean Society iii. 91 (1859); Bentham, flora Australiensis iii. 251.

Not very tall; branchlets slender; leaves scattered, often on rather short stalks, narrow- or sickleshaped-lanceolar, of thin consistence, opaque; lateral veins moderately spreading, only slightly prominent, the intramarginal vein almost contiguous to the edge; oil-dots scanty or concealed; *umbels many-flowered*, axillary and lateral, on a conspicuous almost cylindrical stalk, solitary or sometimes two together; calyces longer than the slender stalklets, their tube obverse-conical, at first slightly constricted towards the middle and at last below the orifice, faintly furrowed and streaked, about twice as long as the semiovate or nearly hemispheric lid; stamens all fertile, inflexed before expansion; *filaments scarlet* or light orange-colored; anthers roundish- or blunt-oval, opening with longitudinal slits; *ovary 2-celled; fruit urnshaped-ellipsoid*, rather long, hardly woody, not prominently angular; valves deeply enclosed.

On the sandstone-tableland and also on sandy ridges from the Victoria-River and its vicinity to Carpentaria, far eastward around the Gulf, often accompanied by E. miniata.

A small or middle-sized tree, highly deserving of a place in ornamental arboreta here and in any other countries free of frost. Flowers in the umbels counted to 28. Style hooked in the flowerbud. Ripe seeds not yet seen, but probably not provided with any appendage.

In ornamental splendor this tree among its congeners vies with E. ficifolia (F. M. fragm. phytogr. Austr. ii. 85; vi. 25) and with E. miniata (A. Cunningham, in Walper's repertorium botanices systematicæ ii. 925). Its flowers share the fiery brilliancy of the last-mentioned species, to which it is also closely allied in its cortical characters, E. phœnicea and E. miniata standing in this respect quite apart from any other Eucalypt (unless E. melissiodora), constituting in the cortical system of the genus a peculiar section, that of Lepidophloiæ. The bark of both is very lameller and friable, outside of a yellowish- or greyish-brown, on fracture partly glittering, and somewhat resembling mica-schist. In E. phœnicea the bark covers the lower branches as well as the stem persistently, but it is easily pulled off, and is less interwoven with fibres than in E. miniata, whereas also in the latter the bark persists on the stem only. Bentham's particular systematic arrangement of the genus necessitated the removal of both species far from each other; the main-differences consist in E. miniata having an almost chalky whiteness about its branchlets and inflorescence, thicker and somewhat broader leaves, heterogenous not isogenous stomata, a lesser number of flowers in the umbels, no well developed stalklets to the calyces, an angularity and greater width of the tube of the latter, more deeply orange-colored filaments, larger and woody fruits (more like those of E. ptychocarpa) with a thicker rim, longitudinal angles and 3–4 valves; it is moreover usually a larger tree than E. phœnicea. The latter differs from all its very numerous congeners in the 2-celled ovary, as first observed by Mr. Bentham and subsequently confirmed by numerous observations of my own.

Species-name from the cinnabar-color or granateflower-red (*φοινίκεος*) of the filaments, in allusion to the fiery-crimson plumage of the mythical bird Phœnix.

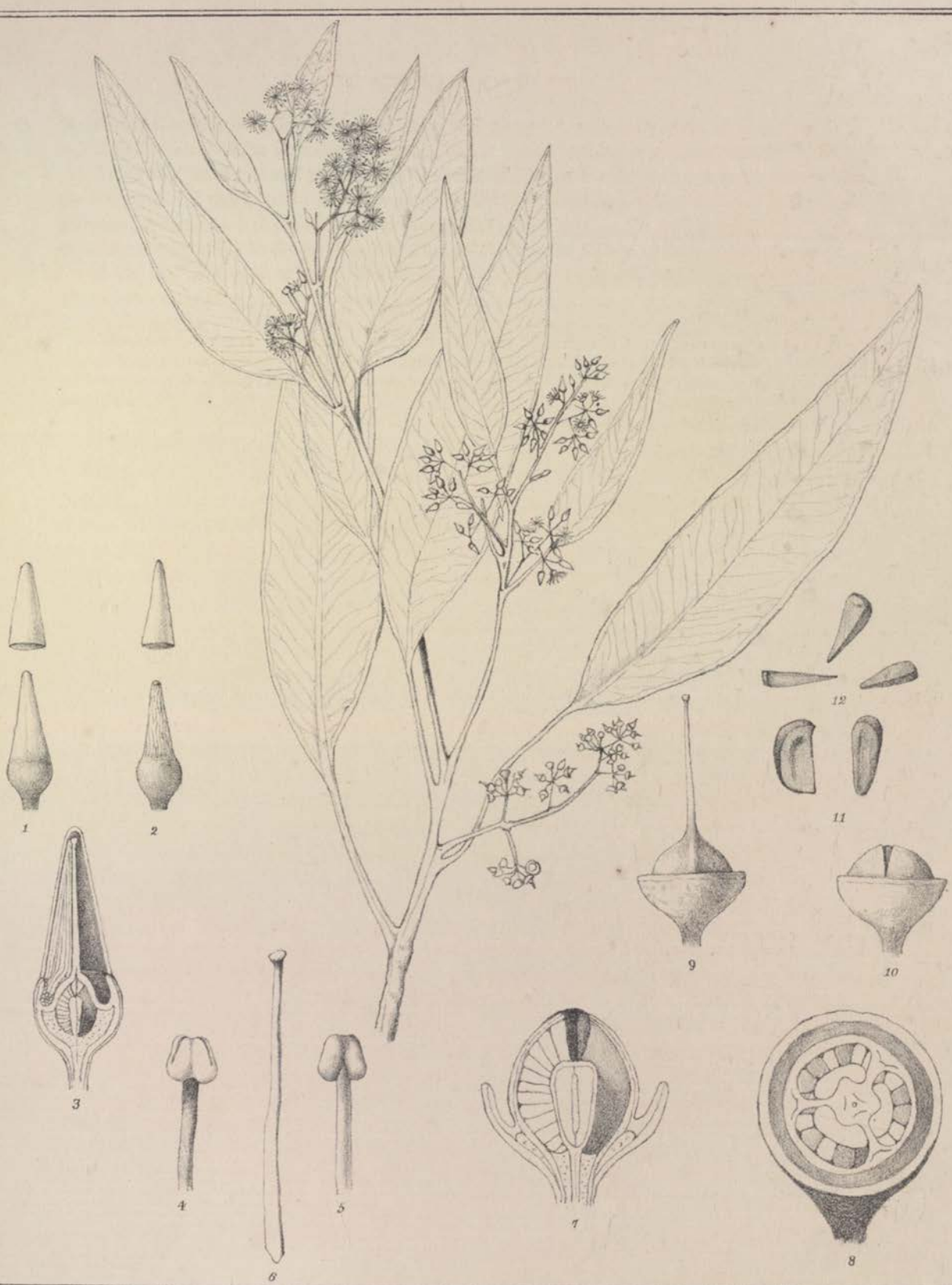
EXPLANATION OF ANALYTIC DETAILS.—1, longitudinal section of unexpanded flower; 2 and 3, front- and back-view of a stamen; 4, style with stigma; 5 and 6, transverse and longitudinal section of fruit; 7, piece of a leaf; all but variously magnified.

In E. phœnicea, as in the preponderance of species of this genus, the stomata occur in about equal number on both pages of the leaves, varying (so far as hitherto ascertained) from 65,000 to

128,000 per square inch. The continuation of a preliminary table of stomata, given under E. pachyphylla, is now offered. I wish it however at the very outset of these observations to be understood, that no undue stress should be laid on the absolute firmness of these interesting physiologic characteristics, as geologic and climatic influences and not less so the age of the tree and other circumstances are likely to render the approximate numbers here noted subject to many changes.

III.—*Stomata isogenous* = on both sides and of approximately equal number.

Eucalyptus alba	149,000
albens	40,000–52,000
angustissima	50,000
annulata	95,000–114,000
Behriana	60,000–70,000
Bowmanni	58,000–60,000
buprestium	54,000–60,000
cæsia	62,000
cinerea	70,000–118,000
clavigera	290,000–360,000
cneorifolia	46,000–65,000
coccifera	50,000–58,000
concolor	45,000–52,000
conoidea	64,000–70,000
coriacea	62,000–120,000
cornuta	100,000–145,000
crebra	75,000–85,000
cosmophylla	90,000–95,000
dealbata	55,000–66,000
dichromophloia	112,000–220,000
doratoxylon	52,000–95,000
drepanophylla	72,000–100,000
dumosa	45,000–54,000
endesmioides	45,000–68,000
erythrocorys	60,000–89,000
eximia	95,000–110,000
falcata	50,000–60,000
fœcunda	108,000–130,000
gamophylla	70,000–77,000
goniantha	60,000–66,000
goniocalyx	52,000–60,000
gracilis	75,000
grandifolia	282,000–320,000
Gunnii	135,000–153,000
hæmastoma	64,000–85,000
hemiphloia	80,000–89,000
incrassata	50,000–64,000
largiflorens	70,000–81,000
latifolia	87,000–115,000
Leucoxylon	95,000–161,000
longifolia	118,000–160,000
loxophleba	110,000–182,000
Luehmanniana	66,000
Eucalyptus macrocarpa	75,000–97,000
macrorrhyncha	45,000–50,000
maculata	95,000–114,000
megacarpa	79,000–85,000
melanophloia	108,000–120,000
melliodora	68,000–90,000
micranthera	65,000–83,000
microtheca	75,000–100,000
occidentalis	95,000–170,000
odontocarpa	81,000
odorata	72,000
Oldfieldi	85,000
oleosa	60,000
pachyphylla	40,000
pallidifolia	60,000–66,000
peltata	275,000
phœnicea	65,000–128,000
platyphylla	116,000–130,000
platypus	79,000–100,000
polyanthema	80,000–118,000
Preissiana	35,000
„	40,000–46,000
pruinosa	90,000–124,000
pulverulenta	115,000–124,000
pyriformis	48,000–50,000
redunca	81,000
Risdoni	48,000–58,000
salmonophloia	46,000–80,000
salubris	70,000–95,000
santalifolia	65,000–72,000
setosa	75,000–91,000
spathulata	99,000–108,000
stellulata	58,000–70,000
Stuartiana	95,000–155,000
tereticornis	85,000–87,000
tetragona	72,000–85,900
tetraptera	46,000–67,000
tetrodonta	155,000–207,000
urnigera	56,000–75,000
viminalis	75,000–85,000
Watsoniana	114,000–145,000
Youngiana	20,000–43,000



R.Austen delt et Lith. Baron von Mueller direxit. C.Troedel & Co.e imp

Eucalyptus Raveretiana. FvM

EUCALYPTUS RAVERETIANA. 9

F. v. M., fragmenta phytographiæ Australiæ x. 99 (1877).

Very tall; branchlets thin, angular; leaves scattered, of thin consistence, oval- or oftener elongate-lanceolar, almost equal-sided or but slightly sickleshaped, opaque, copiously dotted by pellucid oil-glands, paler beneath; veins very fine, slightly distant, the marginal vein very near to the edge; *flowers exceedingly small,* few or several in each umbel, paniculated; calyces on very short stalklets, *the acutely conical lid twice or thrice as long as the hemispheric calyx-tube;* stamens all fertile; anthers renate-cordate, opening by longitudinal slits; style comparatively long; stigma slightly dilatated; *fruits extremely small,* 3- or rarely 4-celled, their valves half exserted, forming an almost hemispheric summit of the fruit; placental axis about twice as long as broad; seeds without any membranous appendage.

In wet forest-valleys and along shady streams, also on the immediate margins of rivers and swamps of East Australia, particularly in the capricornic regions; thus near Rockhampton (Thozet and O'Shanesy); at the Dawson- and Nercool-River (Bowman); near Port Denison (Fitzalan).

This well-marked and stately species received its specific name in honor of Dr. M. C. Raveret-Wattel, of Paris, who as principal secretary of the great French Acclimation-Society identified himself also much with the extensive culture of our Eucalypts in the countries around the Mediterranean Sea, much induces by Mons. Prosp. Ramel and myself, and who published an important essay on this subject: l'Eucalyptus, son introduction, sa culture, ses propriétés et usages.

A tree, attaining a gigantic size, even up to 300 feet at full age. Vernacularly it passes in the districts of its growth as "Grey Gum-tree" and "Iron Gum-tree." Bark shedding its outer layers, at least of the upper branches, by which process they are rendered smooth and grey, but often persistent on the stem, the latter, according to a meritorious observer of Queensland plants, the late Mons. Thozet, finally fully 10 feet in diameter. Foliage periodically almost completely dropping; leaves usually between 3 and 5 inches long, $\frac{3}{4}$–$1\frac{1}{4}$ inch broad, interspersed with some of smaller size, not very narrowly acuminated; the principal lateral veins spreading in a moderately acute angle. Panicles axillary and terminal, varying usually in length between 1 and 3 inches. Flower-stalklets 1–3 lines long. Filaments almost white. Lid membranous; though so considerably exceeding the tube of the calyx in length, yet measuring only about $\frac{1}{8}$th of an inch; neither the stamens longer. Fruit-calyx little broader than one line; its surrounding margin very thin. Sterile seeds narrower, but hardly shorter, than the fertile seeds.

The nearest affinity of this species is to E. microtheca, but the leaves are not of equal green on both sides, also mostly broader, with more concealed veins; the calyces are still smaller, and there is a greater disparity between the length of their lid and tube; the anthers are more kidney-shaped than globular, while the fruits are smaller than those of any other species, excepting the rare North-West Australian E. brachyandra (F. v. M., in Journ of Proceed. of the Linn. Soc. iii. 97) which however in other respects is very different.

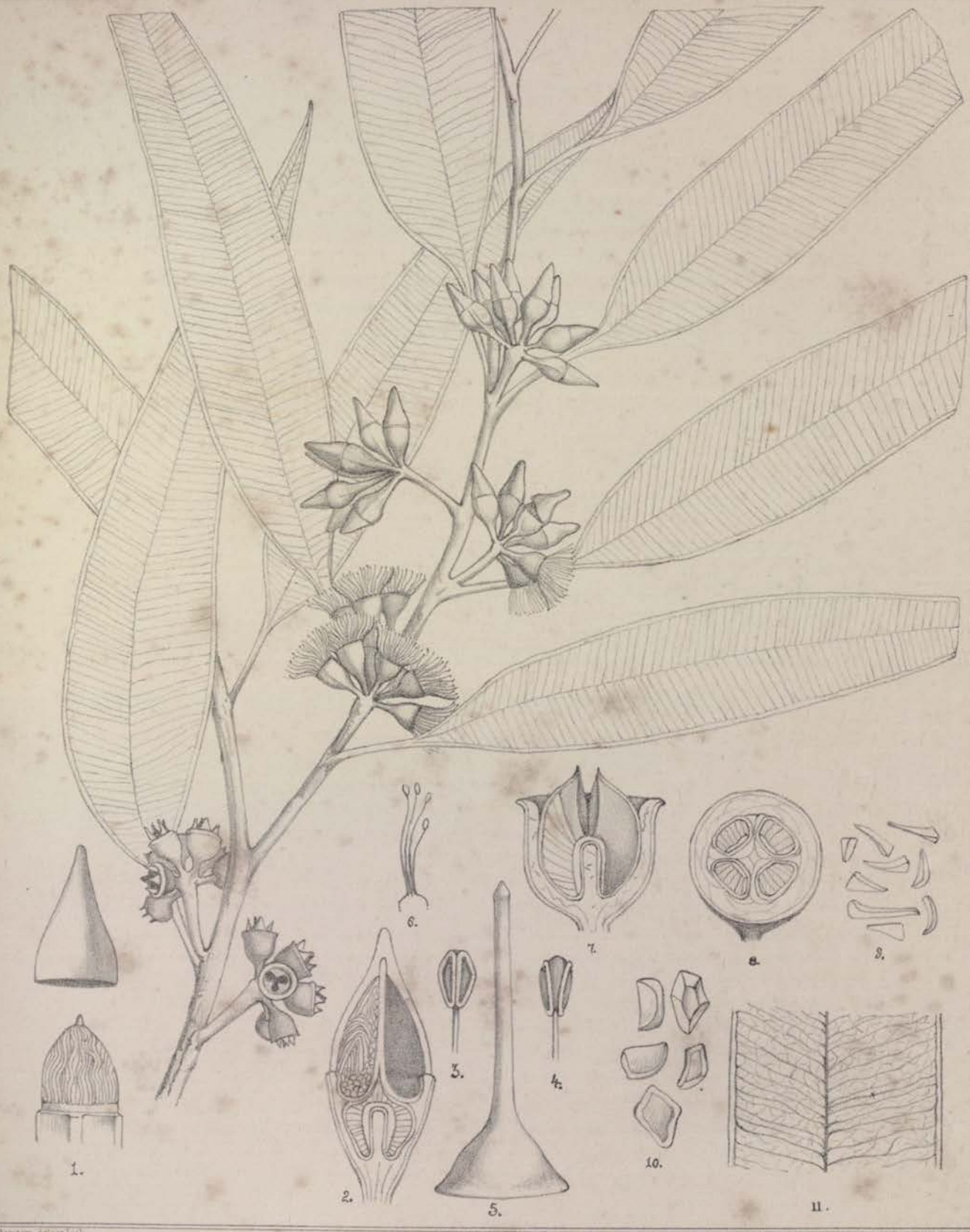
From cuts into the stem an acidulous almost colorless liquid issues in considerable quantity, according to Messrs. Bowman and O'Shanesy, in which respect this species resembles E. Gunni. The foliage is rich in volatile oil. The wood is durable, dark-colored, very hard and valuable for underground-piles and railway-sleepers, irrespective of many other purposes; it will resist the heaviest blow (Bowman and Thozet). This species flowers already when only about 10 feet high.

It is well deserving of trial-culture for industrial purposes, especially as it is also so rich in volatile oil, the particular qualities of which in this instance have never yet been tested.

In all likelihood this will prove one of the most eligible of Eucalypts in wet tropical countries for comparatively quick production of a superior hardwood-timber, and likewise also for hygienic purposes, the evolution of one of the most powerful of all antiseptics, the double oxyd of hydrogen, standing in proportion to the copiousness of essential oil in the foliage of these kinds of trees.

I am still unacquainted with the form of the young seedlings, which in many instances present characteristics peculiar to particular species.

EXPLANATION OF ANALYTIC DETAILS.—1 and 2, calyx, the lid removed; 3, longitudinal section of an unexpanded flower; 4 and 5, front- and back-view of a stamen; 6, style with stigma; 7, longitudinal section of fruit; 8, transverse section of fruit; 9, fruit before opening; 10, ripe fruit; 11, fertile seeds; 12, sterile seeds; variously magnified.



R.Austen del. et Lith. F. v. M. direxit. Steam Litho. Gov. Printing Office Melb

Eucalyptus resinifera. *Smith.*

EUCALYPTUS RESINIFERA.

Smith, in White's Journal of a Voyage to New South Wales, 231 (1790); in Transactions of the Linnean Society of London iii. 284 (1797); Exotic Botany, t. 84 (1805); Andrews, Botanist's Repository vi. t. 400; Hayne, Arznei-Gewächse x. t. 5 (with exclusion of the fruit); T. Nees von Esenbeck, Sammlung officineller Pflanzen, Supplement-Hefte, t. 11; Kippist, in F. M. fragmenta phytographiæ Australiæ ii. 172; Bentham, flora Australiensis iii. 245.

Finally tall; branchlets angular; *leaves* scattered, elongate- or narrow-lanceolar, somewhat or but slightly curved, *paler and opaque beneath; the lateral veins quite numerous, subtle and almost transversely spreading*, the two longitudinal veins only very slightly removed from the edge; pellucid oil-dots more or less obliterated; umbels axillary, on a compressed stalk, bearing usually 6–11 or sometimes 3–5 flowers; tube of the calyx almost semiovate, merging gradually into a stalklet of lesser or occasionally equal or even greater length; *lid conical*, usually twice or thrice as long as the tube and upwards either gradually or more or less suddenly attenuated; stamens all fertile, inflexed while in bud; anthers oblong- or wedgeshaped-oval, with a broad connective and longitudinal slits; stigma not broader than the summit of the elongated style; fruit bellshaped-semiovate or verging towards an hemispheric form, 3- or oftener 4–5-celled, not or rarely angular; *rim raised, almost annular; valves conspicuously protruding*, deltoid-semi-lanceolar; placental column at least twice as long as broad; seeds without any expanding membrane, the fertile much broader than the sterile seeds and very angular.

In New South Wales and Queensland, but not extending far into the inland districts, traced northward hitherto to the vicinity of Rockingham-Bay (Dallachy) and the Daintree-River (Fitzalan). The precise southern limits as yet unknown.

A moderate-sized or lofty tree. *Bark rough, persistent on the stem*, in a greater or lesser degree deciduous on the branches, by which characteristic this species is with ease habitually distinguished from E. saligna, the latter belonging to the Leiophloiæ in the cortical system, while E. resinifera belongs to the Hemiphloiæ. It bears the colonial name of Red or Forest-Mahogany, which appellations are very inaptly given, inasmuch as the wood bears no real similarity to that of the true West Indian Mahogany; according to the Revd. Dr. Woolls the tree passes under several other popular and confusing designations, which very properly might be consigned to oblivion. Should it be deemed desirable to construct a new vernacular name, that of the New South Wales *Kino-Eucalypt* might be found the most appropriate, as it was this species, which brought the Australian Kino first into medical notice. Indeed Dr. White already during the earliest phase of the Botany-Bay-settlement used it against diarrhœa with excellent results, and recorded simultaneously, that the Kino of this tree dissolves completely in spirits of wine, but only one-sixth part of it in water. Hot water, according to Hayne, dissolves rather more than half, and alcohol rather more than two-thirds, ether about one-twentieth. Incisions into the bark expedite and increase the flow of the Kino-sap.

E. resinifera presents considerable variations of form, which is not surprising, when we consider, through what a wide extent of geographic latitude this species ranges. Thus in the wet and hot regions of Rockingham-Bay the leaves assume a broad almost oval form of nearly equal color on both sides and of thicker consistence, while the lid of the calyx becomes suddenly contracted from a semiglobular base; this variety was described as E. spectabilis (F. M., fragm. v. 45); another variety with more elongated leaves, partially paniculated flowers and larger fruits was rendered known as E. pellita (F. M., fragm. iv. 159; Benth. fl. Austr. iii. 246); but augmented material, since accumulated, has proved also this as a tropical luxuriant form referable

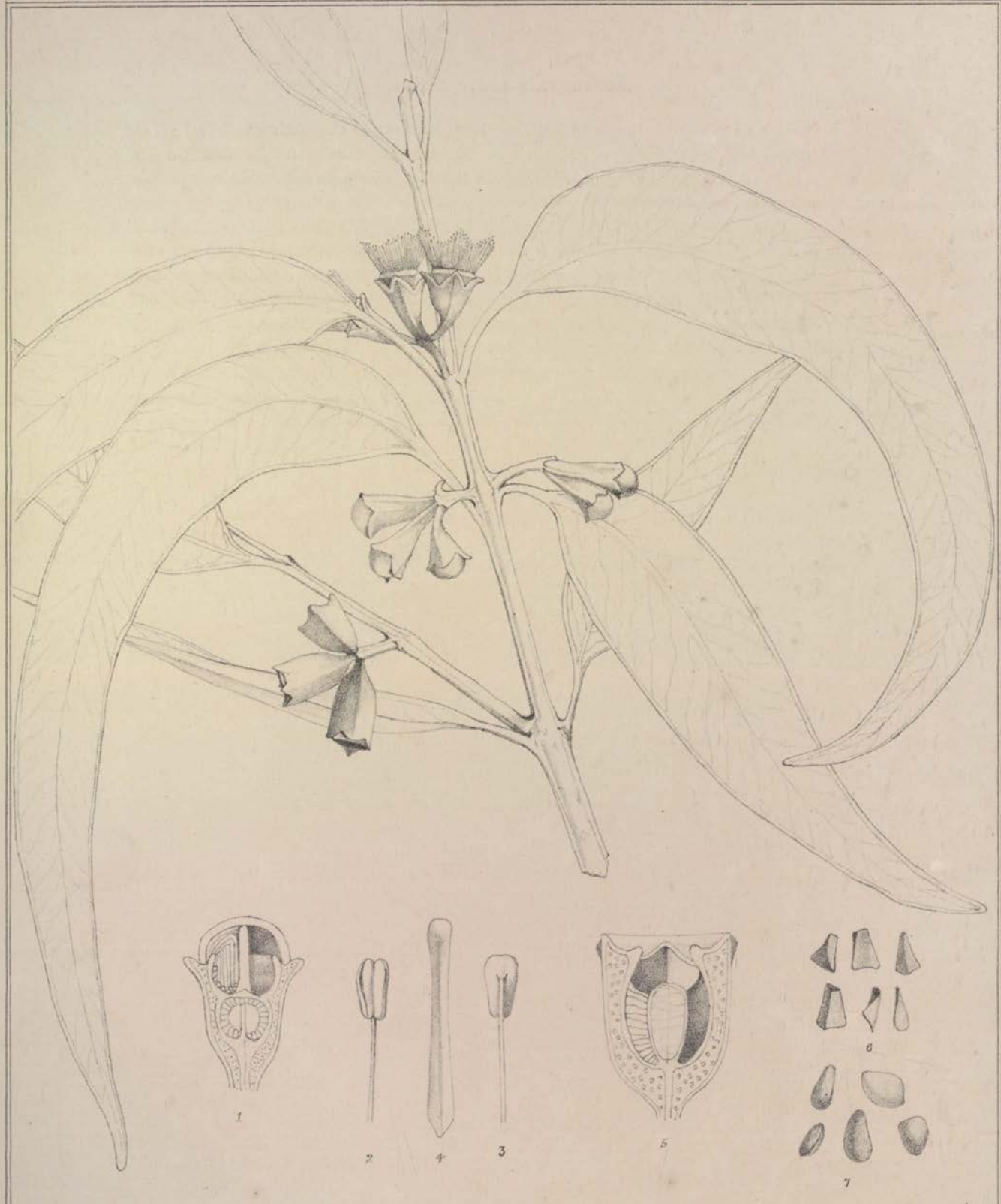
to E. resinifera. Thus leaves occur twice as broad as those of the lithogram, whereas flowers are also found of double the size of those illustrated. In a stunted state this tree, when growing among granite-rocks in New England, may have its flowerstalks much shortened, the stalklets vanishing and the lid abbreviated to a pyramidal-hemispheric form.

The timber is pronounced by the Revd. Dr. Woolls "splendid and as durable as that of the Ironbark-trees" of New South Wales, though the tree itself in outer appearance resembles more the Stringybark-Eucalypts. It ought to be for timber-culture, along with E. rostrata and E. cornuta, one of the most valuable in wet tropical countries; nevertheless in its merits for sanitary purposes it cannot rival with any of the Eucalypts richest in Cajuput-like oil.

EXPLANATION OF ANALYTIC DETAILS.—1, part of flowerbud, the lid separated; 2, longitudinal section of flowerbud; 3 and 4, front- and back-view of anther; 5, pistil; 6, outer stamens; 7, longitudinal section of a fruit; 8, transverse section of a fruit; 9, sterile seeds; 10, fertile seeds; 11, portion of a leaf; variously magnified.

In the Illawarra-district occurs a tree, which attracted great attention in India, not only because of its rapid growth, but also as it proved the best species there to cope with the moist tropical heat. This tree has been cultivated at Lucknow by Dr. Bonavia, who recorded, that it attained in the best soil 12 feet in two years; it was there considered to belong to E. resinifera. It differs however from that species in having the leaves of equal color on both sides with more prominent veins, the intramarginal veins more distant from the edge; thus in venation as also in odor of foliage and fruit the tree in question approaches E. robusta, but its fruit is certainly similar to that of E. resinifera, wanting however the broadish outer ring around its orifice, characteristic of the typical E. resinifera, while the lateral veins of the leaves are not quite so transwersely spreading as in either. If really specifically distinct, the tree might be named E. Kirtoniana in honor of its discoverer.

Eucalyptus punctata (Candolle, prodromus systematis naturalis regni vegetabilis iii. 217) is evidently very closely related to E. resinifera, though Bentham took for it a variety of E. tereticornis with broader and shorter leaves, thicker flowerstalk and very blunt operculum. Dr. Woolls acknowledges perhaps correctly E. punctata, the "Leather-Jacket" of the colonists, as a separate species and places it into the section of Hemiphloiæ. His Parramatta specimens agree precisely with Heyland's drawing in De Candolle's mémoire sur la famille des myrtacées, pl. 4. The main differences, by which E. punctata can be held separate from E. resinifera, are the thinness of its leaves, its general tendency to a paniculate inflorescence, the abbreviated lid of the calyx, the more depressed rim of the ripe fruit and the extremely short in no way or but very slightly protruding valves of the latter; it is brought into closer contact with E. saligna by the size of its flowers and fruits, the shortness of the lid and of the fruit-valves, differing however in the total persistency of the stem-bark, the longer stalklets and the less pointed lid. The reverend gentleman observes, that E. punctata passes among artisans also as "Hickory," that it has a tough and thick bark, that the wood is useful for fencing and other rough purposes, and that the tree attains a height of 70 feet. I find the leaves copiously pellucid-dotted, as the name would imply.



F. Austen del. et Lith.

Baron von Mueller direxit

C. Troedel & C.o imp.

Eucalyptus tetrodonta. F.v.M.

EUCALYPTUS TETRODONTA. | 5

F. v. M., in the Journal of the Linnean Society iii. 97 (1858); Bentham, flora Australiensis iii. 260.

Arboreous; branchlets angular; *leaves opposite*, lanceolar-sickleshaped, opaque, their lateral veins moderately spreading, the intramarginal vein close to the edge; umbels axillary and solitary or sometimes 2 or 3 jointly terminal, each with 3 or seldom 4–5 flowers; flowerstalks hardly shorter than the calyx; stalklets extremely short but angular; bracts 2, opposite, rather large, slowly deciduous; *tube of the calyx conical-bellshaped, provided slightly below the margin with four deltoid teeth;* lid hemispherical, smooth; stamens inflexed before expansion; anthers oval-oblong, opening with longitudinal slits; stigma hardly broader than the style; fruit angular, mostly 3-celled, the discal expansion forming a narrow rim beyond the calyx-teeth; placental axis in age twice as long as broad; valves enclosed; sterile seeds not much narrower than the fertile seeds, all without any membranous appendage.

On the bushy sandstone-tableland of Arnhem's Land (F. v. M.); near Port Essington (Leichhardt); Port Darwin (Schultz); Maria-Island and Liverpool-River (Gulliver); Escape-Cliffs (Hulls).

A kind of Stringybark-tree, but not tall. Stem rather slender. Bark pale, fibrous, coating the branches as well as the stem persistently. Leaves 3–8 inches long, ½–1½ inches broad; the uppermost sometimes alternate. Bracts at the summit of the flowerstalk boatshaped-lanceolar, about ¼ inch long. Calyx measuring when in flower about ½ an inch, when in fruit up to ¾ of an inch in length, so far as hitherto observed. Sterile seeds often narrow-pyramidal and truncated; fertile seeds mostly oblique-oval.

This species is highly remarkable and instructive, inasmuch as the strongly toothed calyx demonstrates some transit towards Angophora, although the lid is noways dissolved into petals as in that genus, nor can the operculum be rightly regarded as petaloid, it being quite of the texture and structure normal in most Eucalypts, indeed in this respect not different from the lid of E. Preissii, E. terminalis, E. Abergiana and a few other species, in which the calyx is rather irregularly ruptured than circumcised by a clearly defined sutural line; at best only the inner layer of the lid could be assumed to be corollaceous, but it is closely connate with the outer stratum as usual in the genus.

E. tetrodonta has no immediate close affinity to any of its congeners, except to E. odontocarpa (F. v. M., in the Journal of the Proceedings of the Linnean Society, iii. 98) from the North-Western regions of Central Australia; this however I found only of shrubby growth, its leaves much narrower, the calyces very considerably smaller on shorter and thinner stalklets, the fruit also of much less size, its minute teeth protruding beyond the outward not decurrent rim.

EXPLANATION OF THE ANALYTIC DETAILS.—1, longitudinal section of unexpanded flower; 2 and 3, front- and back-view of a stamen; 4, style; 5, longitudinal section of a fruit; 6, sterile seeds; 7, fertile seeds; variously magnified.

I may perhaps avail myself at this early opportunity, while issuing the first plates of the Atlas, to point out, that in any arrangement of the species of Eucalyptus according to the cortical system E. tetrodonta would probably merge into the division of Pachyphloiæ, which comprises all the Stringybark-trees. When in 1858 a descriptive essay on those Eucalypts, which from 1855 to 1856 I had personally observed in tropical and eastern subtropical Australia, was offered by me to the Linnean Society, and published in its journal of proceedings iii. 81–101, I explained how by a few simple easily observable characteristics of the bark all Eucalypts could be classified according

to the technic requirements of woodmen, who could not be expected to enter on a discrimination of the various species from such purely scientific differences, on which descriptive botany would rely. Subsequent discoveries of species have not suggested the adoption of any material changes in this first rough grouping according to cortical characteristics for the general guidance of colonists, but the systematic term Pachyphloiæ, adopted collectively for all the Stringybark-trees, might perhaps give way to the still more expressive designation *Inophloiæ*, all Stringybark-trees, as the name implies, producing a very fibrous bark, in which respect they differ materially from the groups of Rhytiphloiæ (comprising many of the so-called "Box-trees") and that of the Schizophloiæ (including the Ironbark-trees), both these groups having a much more solid bark. As however might be imagined, these distinctions are not absolute; and when the persistence of the cortical layers on the main branches of any Stringybark-trees becomes imperfect, we get a transit to the group of Hemiphloiæ, in the leading species of which the branches become smooth from the shedding of the outer and older cortical layers, while the stem remains coated with the complete and gradually very thickened bark.

EUCALYPTOGRAPHIA.

A DESCRIPTIVE ATLAS

OF THE

EUCALYPTS OF AUSTRALIA

AND THE

ADJOINING ISLANDS;

BY

BARON FERD. VON MUELLER, K.C.M.G., M. & PH.D., F.R.S.,

GOVERNMENT BOTANIST FOR THE COLONY OF VICTORIA.

"NON SUCCIDES ARBORIS, NEC SECURIBUS DEBES VASTARE EARUM REGIONEM."—*Liber Deuteronomii* xx. 19.

SECOND DECADE.

MELBOURNE:

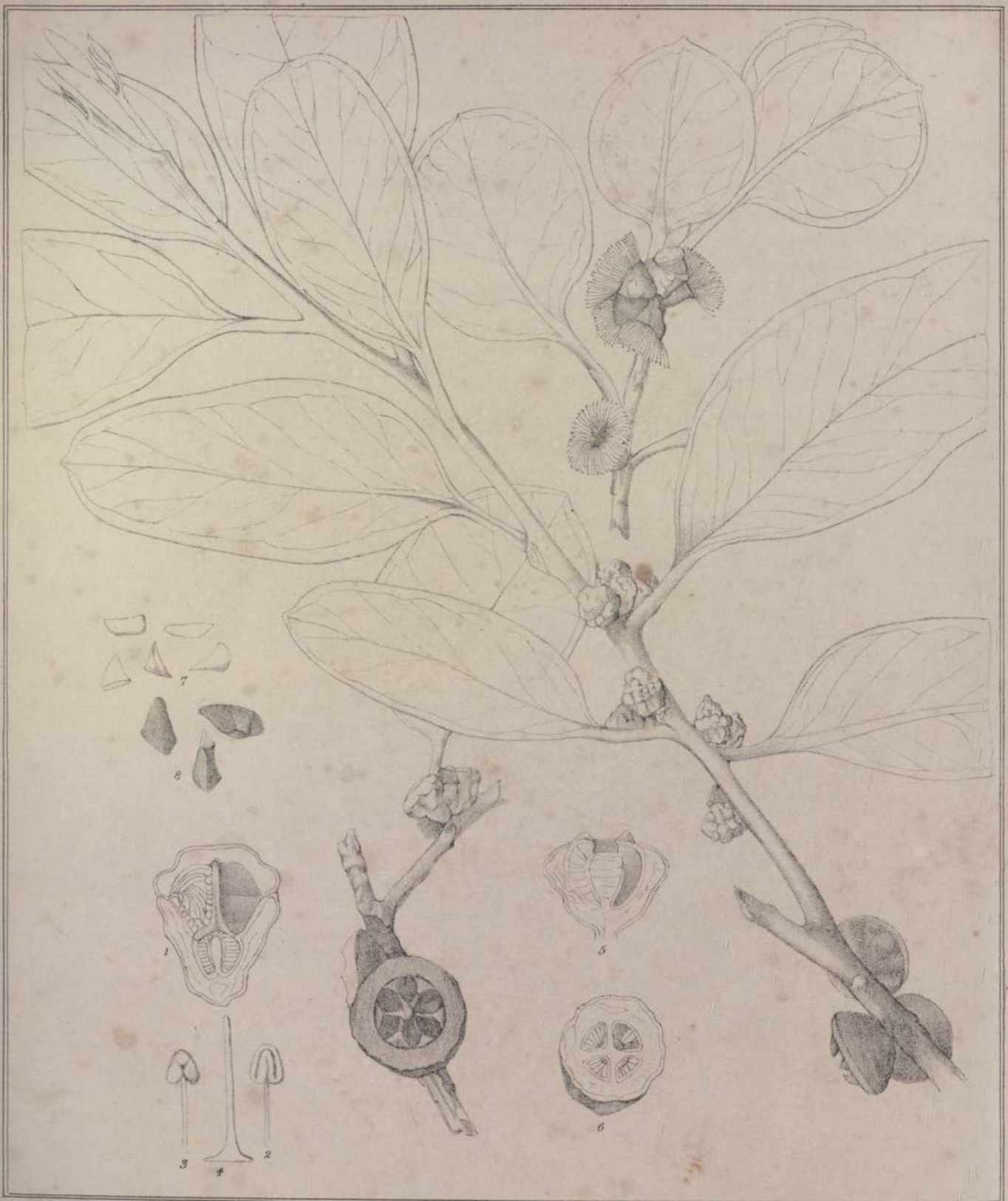
JOHN FERRES, GOVERNMENT PRINTER.

PUBLISHED ALSO BY GEORGE ROBERTSON, LITTLE COLLINS STREET.

LONDON:

TRUBNER AND CO. 57 AND 59 LUDGATE HILL; AND GEORGE ROBERTSON, 17 WARWICK SQUARE.

M DCCC LXXIX.



R. Austen del. C. Tresdel & Co. Lith.

F. v. M. direxit.

Steam Litho. Gov. Printing Office, Melb.

Eucalyptus alpina. *Lindley.*

EUCALYPTUS ALPINA. 11

Lindley, in Mitchell's three Expeditions into the Interior of Eastern Australia ii. 175 (1838); Brogniart et Guillemin, Annales des sciences naturalles, seconde série, xvii. 57; Walpers, repertorium botanices systematicæ ii. 925; F. M., fragmenta phytographiæ Australiæ ii. 68; Bentham, flora Australiensis iii. 225.

Shrubby; branchlets stout, almost cylindrical; *leaves* scattered, on thick stalks, from broad-oblong and *oval to roundish, of thick consistence,* of equal color and shining on both pages, with moderately spreading faint and not crowded veins, the intramarginal vein distinctly removed from the edge; the oil-dots concealed or scantily developed; *flowers sessile in the axils,* solitary or oftener from 2 to 4 or rarely 5 together, some not rarely lateral; *calyx more or less warty-rough; the lid irregularly semiovate or semiglobular;* the tube nearly hemispherical, about as long as the lid or slightly longer; stamens incurved while in bud, all fertile; anthers ovate-cordate, opening with longitudinal slits; *fruits almost hemispherical, not angular,* of rather considerable size, its vertical *margin broad,* slightly protruding and ascending, finally convex; valves 4–6, half-exserted, deltashaped; seeds without any appendage, the sterile seeds mostly not very narrow.

On the summit of Mount William, at an elevation of over 4,000 feet.

This in many respects remarkable species was discovered by Colonel Sir Thomas Mitchell, when that eminent geographer explored a vast extent of Victoria, discovered also the Grampians and ascended (in July 1836) the mountain, to the top of which this Eucalypt is absolutely restricted; for it does not even extend to any other summits in the chain, of which Mount William is the culminating point, seeking unlike most of its congeners a subalpine zone for its habitation (with us always first indicated by the presence of Celmisia longifolia), though I have sought for the same species in vain anywhere in the Australian Alps. But it is not the only one, which endures quite a frigid clime, inasmuch as in the snowy mountains of Victoria and New South Wales the timber-vegetation terminates also with species of Eucalyptus, thus E. Gunnii and E. pauciflora in a dwarfed state ascending to heights of over 5,000 feet in the Australian Alps, while in Tasmania E. vernicosa, E. coccifera and E. urnigera (also with E. Gunnii and E. pauciflora) penetrate likewise to alpine elevations, and brave the keen frosts and snow-storms, which in the uppermost Eucalyptus-region occur for several months in the year.

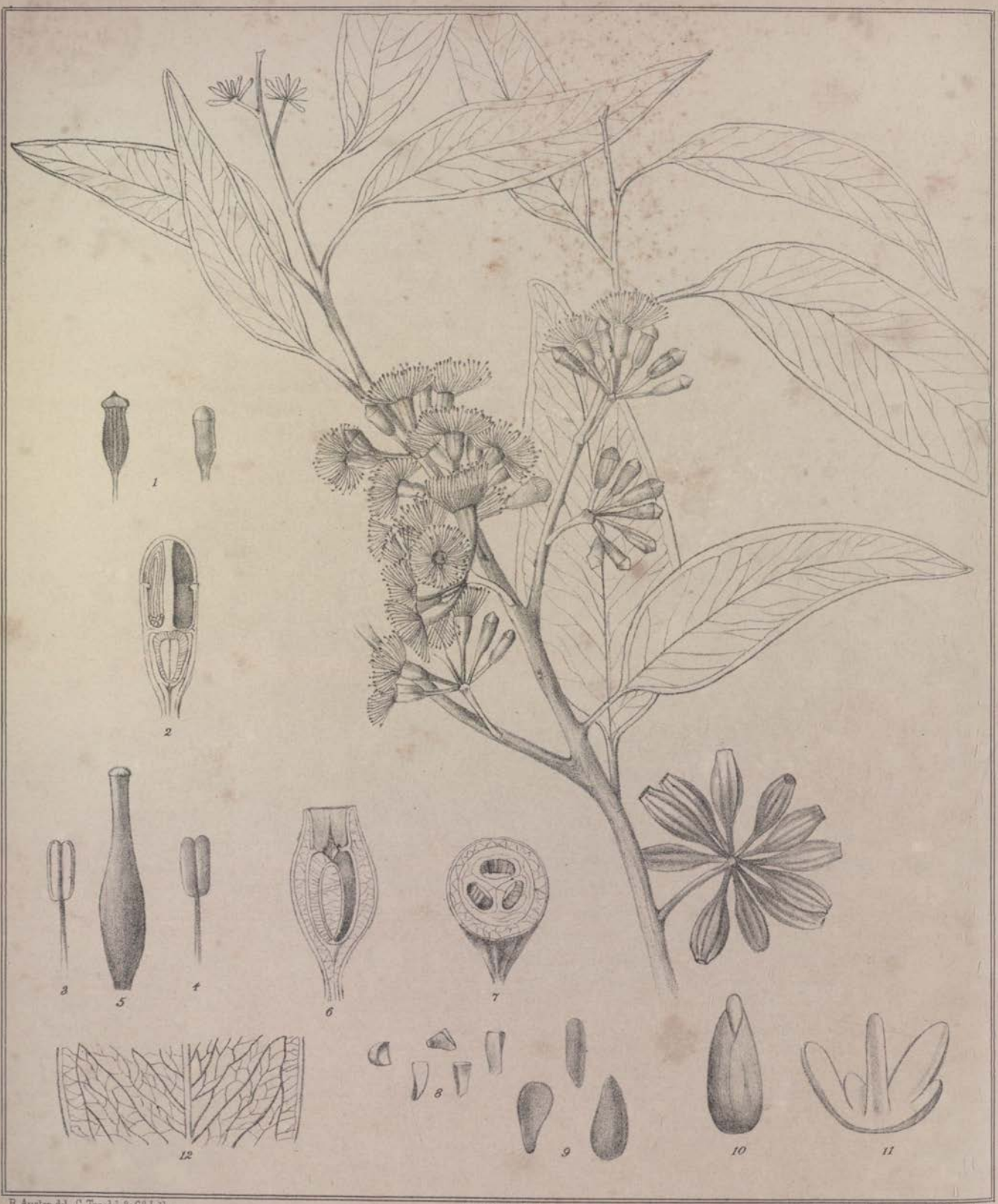
It will be interesting for the geography of plants to ascertain, whether the Eucalyptus-vegetation of New Guinea advances there also to the as yet unexplored alpine regions.

E. alpina is remarkable also for being restricted to a small area of one single mountain, just as is the case with a few of its companions or neighbors there, for instance Pultenæa rosea, Calycothrix Sullivani, Bauera sessiliflora, Stylidium soboliferum; and similar isolations are shown by Wittsteinia vacciniacea, which is confined to the highest regions of Mount Baw-Baw exclusively, while Goodenia Macmillani occupies a short distance of one single slate-valley on the MacAllister-River, not to allude to some similar instances even within our colony. Here however a hope may be expressed, that plants of such extreme rarity should not be allowed as in St. Helena (and as unfortunately also in many other parts of the globe) to be swept away and even utterly annihilated, when intelligent foresight might protect them ungrudgingly and unmolested in their place of creation, from which they could not wander away. By some slight circumspect exertions we might preserve for the contemplation and delight also of future generations these extremely local forms of the existing creation, whose very representative existence in their almost solitary spots, is so much endangered, aware that divine wisdom called forth even the most scantily distributed organic beings in nature by unalterable laws for designed purposes. Hence no efforts of any

evolution- or transmutation-experiments, by which these theories might be brought to a crucial test, will ever give us back again even one single real species, whether the Moa or Dodo or even the humblest plant, when in its struggle for existence it became finally lost.

The danger of E. alpina becoming extinct is lessened by its being brought into culture in our Botanic Garden, where I reared it from seeds gathered by myself in 1853. But since that distant time the plant in not altogether unfertile soil remained as dwarf and bushy as in its place of creation, having in a quarter of a century hardly attained a height over about a dozen feet and shown no tendency to form a distinct stem. Therefore E. alpina is probably the slowest in growth of all Eucalypts, and in this respect its contrast to E. globulus is all the more marked and singular, inasmuch as it stands to that species of unparalleled celerity of growth among hardwood-trees in nearest systematic affinity, though specifically quite distinct. E. globulus however, irrespective of its gigantic stature, differs in much longer and narrower leaves, sickleshaped-attenuated and of lesser thickness with usually less immersed veins, in longer leaf-stalks, flowers probably never more than 3 together and always of larger size, in a comparatively more depressed lid, in the anthers longer and not almost cordate with a more prominent dorsal gland, in the fruit being mostly very angular from longitudinal prominent verrucular lines, in the generally more depressed rim separated by a deeper channel from the tube of the calyx, in often rather larger valves of not lesser width than the rim; further the oil-dots of the foliage are mostly unconcealed, and the seedlings are totally different. In the fragmenta phytographiæ Australiæ vii. pp. 42–44, notes on the seedlings of many Eucalypts were offered, and those of E. alpina mentioned as rough, with cylindrical stem, opposite oval nearly sessile leaves, dark-green above, hardly 2 inches long. In stature it resembles E. pachyphylla and some few others of the desert-species. Systematically it approaches also in some respects E. cosmophylla and E. Preissiana, but the differences between these are so great, as to need no special exposition.

EXPLANATION OF ANALYTIC DETAILS.—1, longitudinal section of an unexpanded flower; 2 and 3, front- and back-view of a stamen; 4, pistil; 5 and 6, longitudinal and transverse section of fruit; 7 and 8, sterile and fertile seeds; all magnified, but in various degrees.



R.Austen del. C. Troedel & Cº Lith. F.v M direxit. Steam Litho. Gov. Printing Office Melb.

Eucalyptus corynocalyx. *F.v.M.*

EUCALYPTUS CORYNOCALYX. 12

F. v. M., fragmenta phytographiæ Australiæ ii. 43 (1860); Bentham, flora Australiensis iii. 218; E. cladocalyx, F. M., in Schlechtendal's Linnæa xxv. 388 (1852); Miquel, in Nederlandisk Kruidkundig Archiev iv. 135; C. Mueller, in Walpers annales botanices systematicæ iv. 825.

The Sugary Eucalypt.

Leaves scattered, broad- or oftener elongate-lanceolar, slightly curved, upwards very gradually narrowed, scantily or not perforated by oil-dots, with an oily lustre on both sides, *somewhat paler beneath;* veins numerous, moderately spreading, the two longitudinal veins often distinctly removed from the edge; umbels lateral or axillary, frequently crowded below the leaves, on almost cylindric stalks, bearing from 4 to 16 flowers; stalklets shorter than the calyx; *lid hemispheric,* quite blunt or slightly pointed, much shorter than the bellshaped cylindric tube of the calyx; stamens all fertile, acutely inflexed in bud; anthers almost oval, opening with longitudinal slits; style very short; stigma not dilated; *fruit urnshaped-ellipsoid, longitudinally streaked;* attenuated into a conspicuous stalklet, 3-celled; its rim narrow-compressed; valves short, deeply enclosed; placental axis about three times as long as wide; seeds without any membranous appendage, the sterile seeds mostly rather broad.

Along Spencer's Gulf in many places; thence dispersed westward at least as far as Streaky Bay (Colonel Warburton); on the stony declivities of Mount Remarkable and at Wirrabara, ascending to considerable elevations (J. E. Brown); about the lower Wimmera (J. Allen); probably to be found yet in many interjacent localities.

This tree, according to annotations from the Inspector-General of South-Australian forests, reaches a height of 120 feet, the trunk attaining a final diameter of 5 or even 6 feet at about 5 feet from the ground; length of bole for timber up to 60 feet. Bark smooth (Leiophloiæ). The wood has come into use for fence-posts and railway-sleepers; its durability is attested by the fact, that posts fifteen years old showed no signs of decay. The sweetish foliage attracts cattle and sheep, which browse on the lower branches, saplings and seedlings, unlike what occurs with almost any other kind of Eucalypt (J. E. Brown), unless E. Gunnii.

The specific name is derived from the calyx, somewhat clubshaped while in its unexpanded state. The nearest affinity of Eucalyptus corynocalyx is with E. urnigera (J. Hooker, in the London Journal of Botany vi. 477; Flora Tasmanica i. 134, t. lvi.), which species is however strictly confined to the alpine regions of Tasmania, and probably never attains a height over 50 feet; moreover the leaves of the latter are of equal green on both sides and copiously beset with pellucid oil-glands; nor is the tube of the calyx wrinkled or streaked. The shape of the unopened calyx distinguishes E. corynocalyx from any other species hitherto known. The growth of this tree is not of particular celerity, as noticed by me, while watching it under culture for very many years. Mr. Brown remarked, that the base of the stem enlarges into a wide expansion, forming almost a row of ascending little tiers.

For a desert-country this is one of the most eligible among Timber-Eucalypts; on such account I selected this species also, to introduce it into the more arid back-country of Algeria along with many other congeners, first transferred by me early to that part of the globe. It seems to have been this species, which attracted my attention as a valuable timber-tree, when I hurriedly crossed the Flinders-Ranges as far back as 1851. Among the Timber-Eucalypts, capable of bearing the often protracted droughts and also the extreme heat of desert-regions, may be noted as deserving primary consideration for quick wood-culture: E. polyanthema, E. bicolor, E. salubris,

E. ochrophloia, E. salmonophloia and perhaps E. terminalis. Although E. rostrata is also able to bear the extremes of dry heat, and is for the bulk of its most durable timber far superior to any of the above named other desert-trees, yet it will not thrive away from places, where in clayey subsoil always some humidity exists; hence it occurs only in oases or lines watercourses, though their beds may remain exsiccated for lengthened periods.

Among the Eucalypts of the interior of Northern Australia may be some, also fit to cope with dry excessive heat of any desert-clime; but most of them are not attaining tall stems, and we remained also hitherto almost unacquainted with the particularities of their timber in reference to technic applications; but for fuel every one of them would be useful.

Explanation of Analytic Details.—1, unexpanded flowers of natural size; 2, one of the same cut longitudinally; 3 and 4, front- and back-view of an anther with filament; 5, style and stigma; 6, longitudinal section of a fruit; 7, transverse section of the same; 8 and 9, sterile and fertile seeds; 10, embryo; 11, the same, unfolded; 12, section of leaf; 2–12 variously magnified.

R. Austen del. et Lith. F. v M. direxit. Steam Litho. Gov. Printing Office Melb.

Eucalyptus haemastoma. *Smith.*

Smith, in the Transactions of the Linnean Society iii. 285 (1797); Candolle, prodromus systematis naturalis regni vegetabilis iii. 219; F. M., fragmenta phytographiæ Australiæ ii. 51; Bentham, flora Australiensis iii. 212; E. micrantha, Candolle, prodromus systematis naturalis regni vegetabilis iii. 217; memoire sur la famille des Myrtacées planche 5; E. signata, F. M., in the Journal of Proceedings of the Linnean Society iii. 85.

Finally tall; leaves scattered, sickleshaped-lanceolar, occasionally much narrower or exceptionally also verging to a somewhat oval form, shining and of equal green on both sides; their lateral veins more longitudinal than transverse, the intramarginal vein somewhat removed from the edge; umbels mostly solitary, axillary or lateral or some paniculate, on angular and often somewhat *compressed stalks*, with from 5 to 10 or rarely more flowers on each; tube of calyx broadly obconical, about twice as long as the hemispheric depressed or slightly pointed small lid, not angular, attenuated into a stalklet of the same or somewhat greater length; stamens short, inflected before expansion; *outer filaments sterile; anthers of the fertile stamens cordate-kidneyshaped;* style very short; stigma not dilated; fruit semiovate, 4- or less frequently 5-celled; its *rim depressed or quite flat; valves very short*, deltoid, convergent, usually affixed very close to the summit of the fruit; placental axis about twice as long as broad; seeds without any appendage, the sterile seeds rather short and often comparatively broad.

Known from Illawarra (Cunningham) to the vicinity of Wide Bay (Moore), ascending into the elevated country of New England.

Bark frequently quite smooth or less usually persistent on the stem, but the branches then to a great extent smooth, the tree thus fluctuating between Leiophloiæ and Hemiphloiæ. The variety micrantha with smaller flowers and fruits passes as White Gum-tree, Spotted Gum-tree or even Blue Gum-tree; the ordinary form in its semipersistent state of bark as Blackbutt-tree and indeed under several other and misleading colonial vernaculars.

The rim of the fruit is brownish-red, from which note the species derives its systematic name.

E. hæmastoma approaches in affinity very closely E. Sieberiana; but its bark is not so deeply furrowed in its persistent portion on the stem; it is further distinguished by somewhat broader leaves with more spreading and more prominent veins, by the usually greater number of sterile stamens and by the frequently shorter fruit, which thus verges more into an hemispheric form. Both E. hæmastoma and E. Sieberiana belong to the series of Heterostemones, notwithstanding Mr. Bentham placing the latter into that of the Renantheræ.

Although the leaves of full-grown trees are like those of E. piperita, yet the seedlings are quite different, being perfectly smooth with their leaves opposite short-stalked and lanceolar, not rough broad and scattered as in E. piperita; it differs also from that species in the often smooth bark, shorter calyx-lid, sterile stamens and the more truncate fruit with less contracted and broader rim.

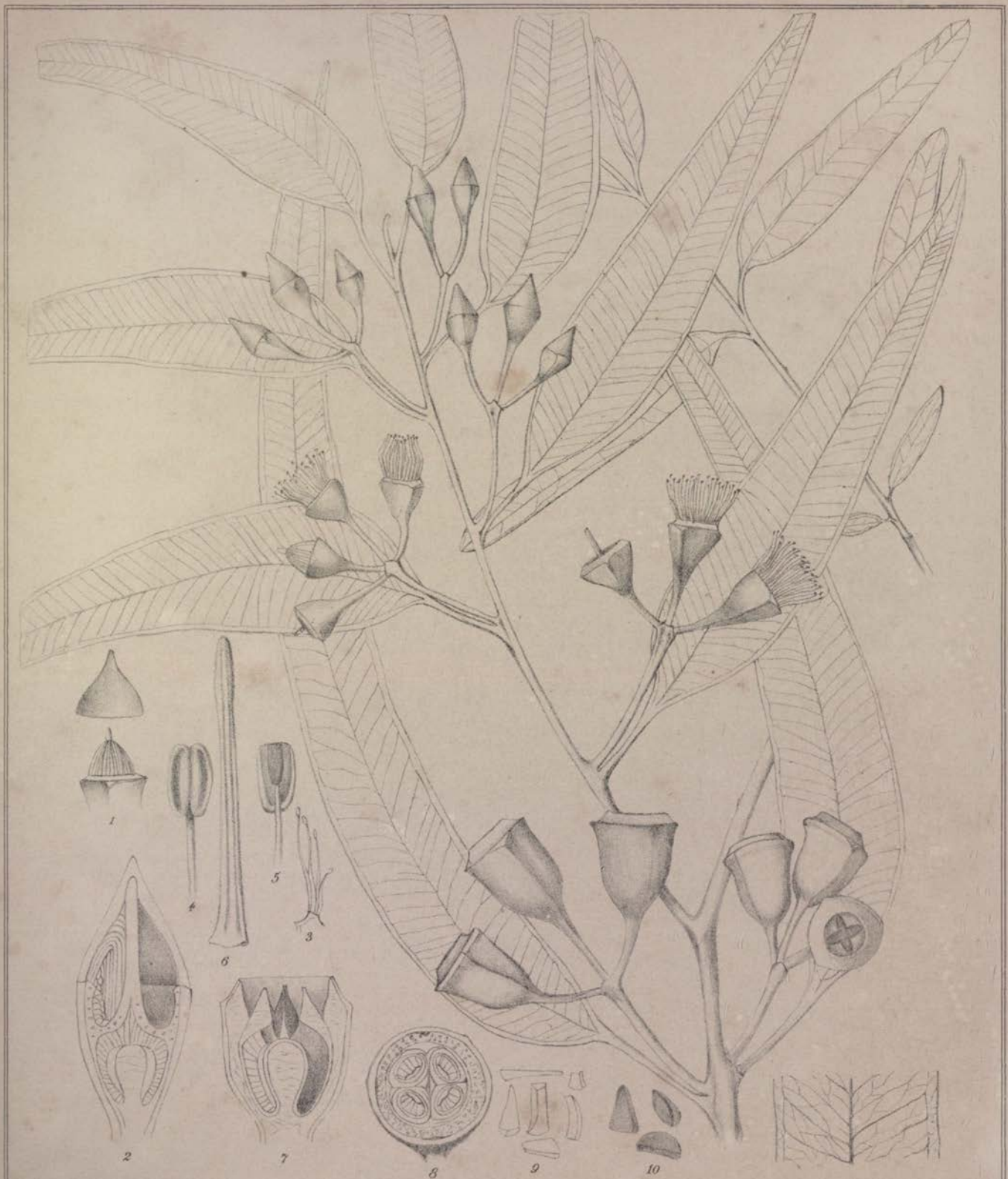
E. hæmastoma occurs however also occasionally with bark persisting up to the last branches, according to Mr. Wilkinson, and would then come under the category of the Stringybarks; in such a state for instance it is known from the Dromedary-Range up to 1,500 feet above sea-level, in the silurian formation. Mr. C. Walter also notes what appears to be this species as a Stringybark-tree towards the Upper Yarra, though the operculum of the flowerbuds is more conical.

The wood is not of any great value for timber-purposes and is apt soon to decay, but furnishes a fair sort of fuel and material for rough carpentry.

EXPLANATION OF ANALYTIC DETAILS.—1, upper portion of calyx, the lid detached; 2, longitudinal section of unexpanded flower; 3 and 4, front- and back-view of anther; 5, sterile and fertile stamens in situ; 6, style and stigma; 7 and 8, longitudinal and transverse section of fruit; 9 and 10, sterile and fertile seeds; 11, portion of leaf; all magnified.

E. hæmastoma is one of the few species, published already in the last century. As it is of some interest to note, how in a long series of years the members of this great genus became successively known, I append here a chronologic index of those, which hitherto have been recorded as well established species, though their validity has not yet in all instances been absolutely confirmed.

1788: Eucalyptus obliqua L'Herit.; 1790: capitellata, resinifera, piperita Smith; 1793: tereticornis, robusta, corymbosa Smith; 1797: botryoides, saligna, hæmastoma, paniculata, pilularis Smith; 1799: cornuta, globulus Labill.; 1802: marginata Smith; 1806: viminalis, cordata, amygdalina, incrassata Labill.; 1819: pulverulenta Sims; 1822: longifolia Link; 1826: alba Reinw.; 1827: eugenioides, pauciflora, stricta Sieb.; 1828: obtusiflora, cneorifolia, gomphocephala, punctata Cand., stellulata Sieb.; 1830: calophylla R. Br.; 1832: Moluccana, Roxb.; 1837: occidentalis, rudis, decipiens Endl.; 1838: alpina Lindl.; 1842: macrocarpa, Hook.; 1843: miniata, melliodora, clavigera, dumosa, dealbata Cunn., polyanthema, pruinosa, setosa, acmenoides, oligantha, eximia, ferruginea Schauer; 1844: concolor, Preissiana, fœcunda, redunca Schauer, spathulata, maculata Hook., Gunnii J. Hook., Lehmanni Preiss; 1847: vernicosa, Risdoni, coccifera, urnigera J. Hook., falcata, goniantha Turcz., odorata Behr, rostrata Schlcht.; 1848: citriodora, populifolia Hook.; 1849: uncinata, pyriformis, tetraptera Turcz., Decaisneana Bl.; 1852: erythronema, obcordata Turcz.; 1853: macrorrhyncha F. v. M.; 1854: Behriana, cosmophylla, gracilis, largiflorens, Leucoxylon, santalifolia F. v. M.; 1858: aspera, brachyandra, crebra, dichromophloia, exserta, hemilampra, latifolia, leptophleba, melanophloia, microtheca, odontocarpa, pachyphylla, patellaris, phœnicea, platyphylla, ptychocarpa, terminalis, tesselaris, tetrodonta, trachyphloia F. v. M.; 1859: albens Miq., goniocalyx, Stuartiana F. v. M.; 1860: corynocalyx, doratoxylon, erythrocorys, eudesmioides, ficifolia, hemiphloia, megacarpa, microcorys, oleosa, F. v. M.; 1862: buprestium F. v. M.; 1863: angustissima, decurva, diversicolor, pallidifolia F. v. M.; 1864: tetragona F. v. M.; 1865: orbifolia F. v. M.; 1866: grandifolia, perfoliata R. Br., annulata, cæsia, Drummondi, leptopoda, loxophleba, pachyloma, patens, peltata, siderophloia Benth., Bowmani, cinerea, drepanophylla, grossa, macrandra, micranthera F. v. M.; 1869: pachypoda F. v. M.; 1875: Papuana F. v. M.; 1876: Rameliana, salubris, Youngiana F. v. M.; 1877: Raveretiana, Torelliana, Watsoniana, F. v. M.; 1878: Abergiana, Baileyana, Cloeziana, gamophylla, Luehmanniana, ochrophloia, Planchoniana, salmonophloia F. v. M.; 1879: Sieberiana, Kirtoniana F. v. M., Cooperiana F. v. M. inedit.



R. Austen del. C. Troedel & Cº Lith. F. v M. direxit. Steam Litho Gov. Printing Office, Melb.

Eucalyptus longifolia. *Link & Otto.*

Link, enumeratio plantarum horti regii botanici Berolinensis ii. 29 (1822); Link et Otto, icones plantarum selectarum horti regii botanici Berolinensis 97, t. 45 (1826); Candolle, prodromus systematis naturalis regni vegetabilis iii. 216; Bentham, flora Australiensis iii. 227; E. Woollsii; F. v. M., fragmenta phytographiæ Australiæ ii. 50.

The "Woolly Butt."

Finally tall; leaves scattered, elongate-lanceolar or more or less sickleshaped, of equal green on both sides, not shining; lateral veins subtle, very spreading and rather close to each other, the circumferential vein only slightly distant from the margin of the leaves; flowerstalks slender, often curved, of conspicuous length, with from *two to four flowers;* stalklets as long as the calyx or variously shorter; *lid conical, as well as the tube of the calyx pale,* the latter broadly obconical, hardly as long as the former; stamens all fertile, inflexed while unexpanded; anthers cuneate- or oblong-oval, their cells parallel and slit longitudinally; stigma not dilated; *fruits rather large, semiovate-bellshaped, the rim ascendant or channelled, the vertex very convex;* valves 4, rarely 5 or 3, enclosed; seeds without any appendage, the sterile seeds mostly narrow.

In forest-land from the lower Genoa-River to the neighborhood of Port Jackson, scattered along the coast-country, thence extending to the base of the Blue Mountains.

A tree, known to attain under favorable circumstances a height of 150 feet. *Bark persistent, grey,* rough or wrinkled, somewhat fibrous. Wood in request for fuel, less for timber, as it is often traversed by Kino-sediments. When sound, the wood is sought for wheelwrights' work, according to Sir William Macarthur; other authorities have established its durability for fences. Leaves exceptionally nearly 1 foot long; their oil-dots usually somewhat concealed, though copious. Flowers seldom solitary, not rarely larger than illustrated; tube of the calyx with two to four or without any angles; lid sometimes protracted into a beak-like apex; rim of the fruit-calyx variable in width, but never narrow. Connective of the anthers conspicuously callous-glandular. Seedlings smooth, their leaves narrow, paler beneath; some of their earlier leaves opposite, the rest soon scattered.

Without access to the illustration, issued from the Berlin Botanic Garden, I failed originally to identify this species, although alluding then already to its apparent affinity.

E. longifolia is not easily mistaken for any other of its congeners; it has however some external resemblance in its floral organs and in its fruit to E. Leucoxylon and E. cæsia; but the former of these belongs to the Heterostemones, and both differ in having the rim of the fruit internally descendent, not externally ascendant; irrespective of this they are both separated by other differences. The resemblance to E. erythronema and E. cosmophylla is still less marked.

Dr. Josef Moeller has given a histologic account of the bark of this tree (in der Zeitschrift des allgemeinen oesterreichischen Apotheker-Vereins 1875, n. 15), to which essay I shall refer fully in connection with the histology of other Eucalyptus-barks on some future occasion.

Explanation of Analytic Details.—1, upper part of calyx, the lid lifted; 2, longitudinal section of an unexpanded flower; 3, stamens in situ; 4 and 5, front- and back-view of an anther; 6, style and stigma; 7 and 8, longitudinal and transverse section of a fruit; 9 and 10, sterile and fertile seeds; 11, portion of a leaf; 1 and 3, natural size; 2 and 4 to 11, more or less magnified.

The bark of E. longifolia can be converted into packing-paper, as shown already during the International Exhibition of 1867, when also Kino-tannic acid was prepared in my laboratory from the bark of this tree, the yield proving 8·3 per cent. The percentage of Kino-tannic acid in the

bark of different Eucalypts is very variable, as may be noted from experiments, instituted under my directions by Mr. L. Rummel, fresh bark being used for the purpose, the tannic principle loosing its solubility and also its efficiency to some extent by exsiccation and chemical decomposition.

In 100 parts of fresh Bark.	Kino-tannic Acid.	Water.
Eucalyptus Leucoxylon (rough-barked)	21·94	51·13
globulus	4·84	51·54
rostrata	8·22	51·16
Gunnii	3·44	54·09
polyanthema	3·97	46·66
melliodora	4·03	54·94
obliqua	2·50	36·81
obliqua	4·19	51·59
amygdalina (rough-barked)	3·40	43·25
amygdalina (rough-barked)	3·22	39·63
goniocalyx	4·62	51·00
goniocalyx	4·12	45·50
macrorrhyncha	11·12	35·91
macrorrhyncha	13·41	39·56
viminalis (smooth-bark)	4·88	52·88
viminalis (rough-bark)	5·03	54·10
viminalis (young-tree)	5·97	55·03

R. Austen del. et Lith.

F. v. M. direxit

Steam Lithic Govt Printing Office Melb

Eucalyptus melliodora. *Cunningham.*

EUCALYPTUS MELLIODORA. 15

Allan Cunningham, in Walpers repertorium botanices systematicæ ii. 924 (1843); Bentham, flora Australiensis iii. 210; F. v. M., Introduction to Botanic Teachings, 15, fig. vii.

The honey-scented Eucalypt or Yellow Box-tree.

Leaves scattered, narrow lanceolar or somewhat sickleshaped, sometimes verging into an oblong or oval form, not very long, mostly of a dull-green on both pages, seldom shining; their lateral veins neither very spreading nor very numerous nor usually prominent, the marginal vein distinctly removed from the edge; oil-dots rather copious, but many concealed; umbels axillary or lateral and solitary or terminal and often partly paniculate, on short slender stalks, usually with from 4 to 7, seldom 3 or 8, small flowers; calyx on a thin stalklet; its tube semiovate or broadly obverse-conical, nearly as long as or sometimes distinctly longer than the *semiglobular-conical blunt or somewhat acute lid; outer stamens destitute of anthers;* filaments pale; anthers very minute, nearly as broad as long, upwards dilated, opening near the summit with pores or short slits; *stigma much dilated; fruit truncate-semiovate,* small, not angular, 5- to 6- or sometimes 4-celled; rim not strongly compressed, comparatively broad or ascendant; placental axis hardly twice as long as broad; valves very short, quite enclosed; seeds very small, without any expanding membrane.

Chiefly on ridges, from the Pyrenees and Loddon extending widely south- and eastward through the colony of Victoria and far into New South Wales, reaching New England and the upper tributaries of the Darling-River northward, with us chiefly occurring in the silurian formation, but also descending into valleys of the pleistocene age and even to the coastlands, but according to Mr. Wilkinson occurring also in the granitic and Devonian formation, never ascending to high elevations.

The "Dargan" of the Gippsland aboriginal tribes.

A middle-sized tree, but exceptionally attaining a height of about 250 feet (Howitt, Falck) and a basal stem-diameter of 8 feet (Robinson). Bark outside brownish-grey, inside yellowish or sometimes almost gamboge-color when first removed (Wilkinson), more or less persistent on the stem, the persistent portion thick and slightly fibrous, often contorted and turned about zig-zag in all manners of ways (Robinson). Branches often to a large extent or entirely smooth. Timber of a yellowish color and when dry extremely hard, very durable and heavy, also of remarkable toughness, but difficult to work and as a rule not fissile; in texture much like that of E. rostrata; much utilized for spokes, rollers, heavy framework and for the best of naves, cogs and treenails, also for rougher kinds of work such as telegraph- and fence-posts, rails and slabs. It cannot well be sawn into planks on account of the frequent occurrence of broad perpendicular slits or cracks intervening between the layers, thus apt also to shell concentrically. In splitting, to use Mr. Howitt's words, it is necessary to back it off, as it will not quarter. Excellent for fuel. The specific gravity of fully seasoned wood varies from about 0·965 to 1·125, or 60 to 70 lbs. per cubic foot. Branches often pendulous, the branchlets mostly very slender. Stalklets of flowers and fruits not seldom longer than exhibited in the illustration.

The tree will live on poor soil, but it is not of particularly quick growth. It bore since very many years the name of "Yellow Box," under which appellation it was noted already in Dr. Leichhardt's collection in 1843. Long ago in my official report to the Victorian Parliament, submitted in 1869, I pointed out, that a ton of fresh branches and leaves of E. melliodora would

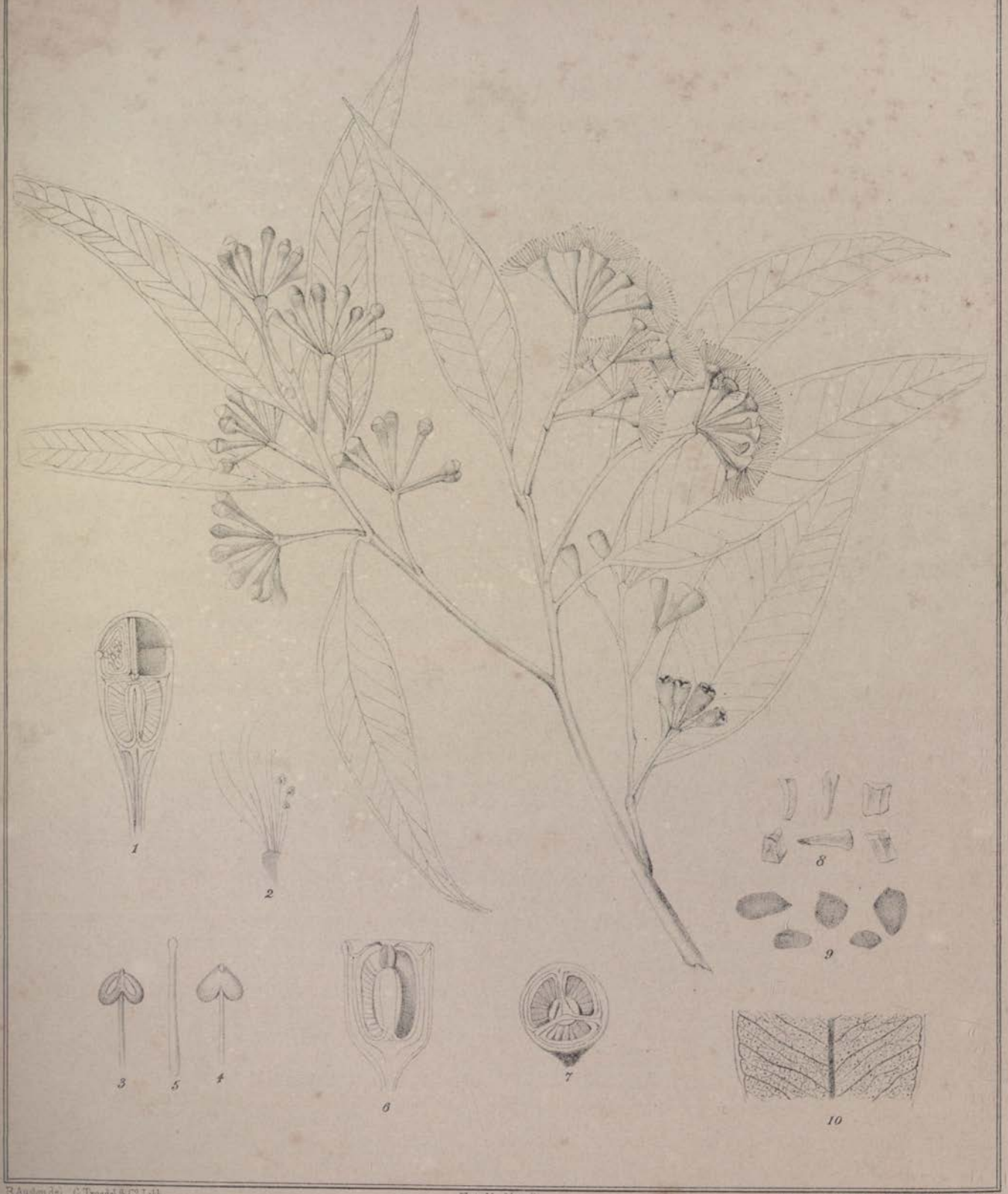
furnish about 2 lbs. 12 ozs. of pure potash, but much more crude pearlash, according to an experiment instituted in my laboratory.

The medullary rays are very distinct, occurring in four or less rows of elongated cells longitudinally conjoint; the vascular tubes show a diameter of only about 0·09 mm. or often less width, with comparatively thick and copiously dotted walls. Dr. Josef Moeller first observed, that the Parenchyma is more extensively developed in the wood of this species than in that of many other Eucalypts, contrasting well by its delicate cell-walls and irregular contour with the less wide and roundish transverse section of the wood-fibres, the diameter of the latter being only about 0·012 mm.

E. melliodora differs as a species from E. Leucoxylon irrespective of the differences of the wood, in the less deeply furrowed persistent portion of the bark and in the yellowish tinge of its inner layers, in usually smaller leaves, flowers and fruits, shorter flowerstalks and mostly also less elongated stalklets, further in more numerous flowers of the umbels with a tendency to a partially paniculate disposition, often in a less pointed lid and in the fruit generally more contracted at the orifice.

The leaves of seedlings are scattered, often oval or oblong and slightly stalked, while in E. Leucoxylon they are as a rule opposite, sessile and broader towards the base; but these discriminations need to be still further followed up.

Explanation of Analytic Details.—1, summit of calyx, lid detached; 2, longitudinal section of unexpanded flower; 3, some sterile and fertile stamens in situ; 4 and 5, front- and back-view of anther; 6, style and stigma; 7 and 8, longitudinal and transverse section of fruit; 9, seeds; 10, portion of a leaf; all variously magnified.



R.Austen del. C.Troedel & Co Lith. F. v.M. direxit. Steam Litho. Gov Printing Office, Melb.

Eucalyptus microcorys. F.v.M.

EUCALYPTUS MICROCORYS. 16

F. v. M., fragmenta phytographiæ Australiæ ii. 50 (1860); Bentham, flora Australiensis iii. 212.

The "Wangee." Finally very tall; *leaves* scattered, narrow- or oftener broad-lanceolar and somewhat sickleshaped, *of thin almost papery consistence, most copiously porous or dotted with oil-glands, paler and opaque beneath;* their veins very fine, numerous and very much spreading, the longitudinal veins mostly near to the edge; the terminal umbels paniculate, the axillary umbels solitary, each bearing four to nine flowers; general flowerstalks compressed, but not broadly dilated; flowerbuds passing rather gradually into their stalklet and with them assuming a clubshaped form; *lid minute, membranous, depressed-hemispherical,* hardly pointed, considerably shorter than the tube of the calyx; stamens inflexed in bud; *outer filaments with imperfect or mostly without anthers,* often thickened towards the summit; anthers of the perfect stamens very minute, almost heartshaped, opening by slits; *style very short* and thin; stigma not dilated; fruit small, truncate-ovate, 3–4-celled, with a narrow rim; placental axis more than twice as long as broad; valves deltoid, reaching to near the summit of the fruit or slightly beyond it; fertile seeds broader and less angular than the sterile seeds, without any membranous appendage.

Dispersed from the vicinity of Cleveland-Bay (W. Hill) to the Hastings-River (H. Beckler) in forest-country or on arid or even sandy hills along the coast-side of the ranges, descending to their base.

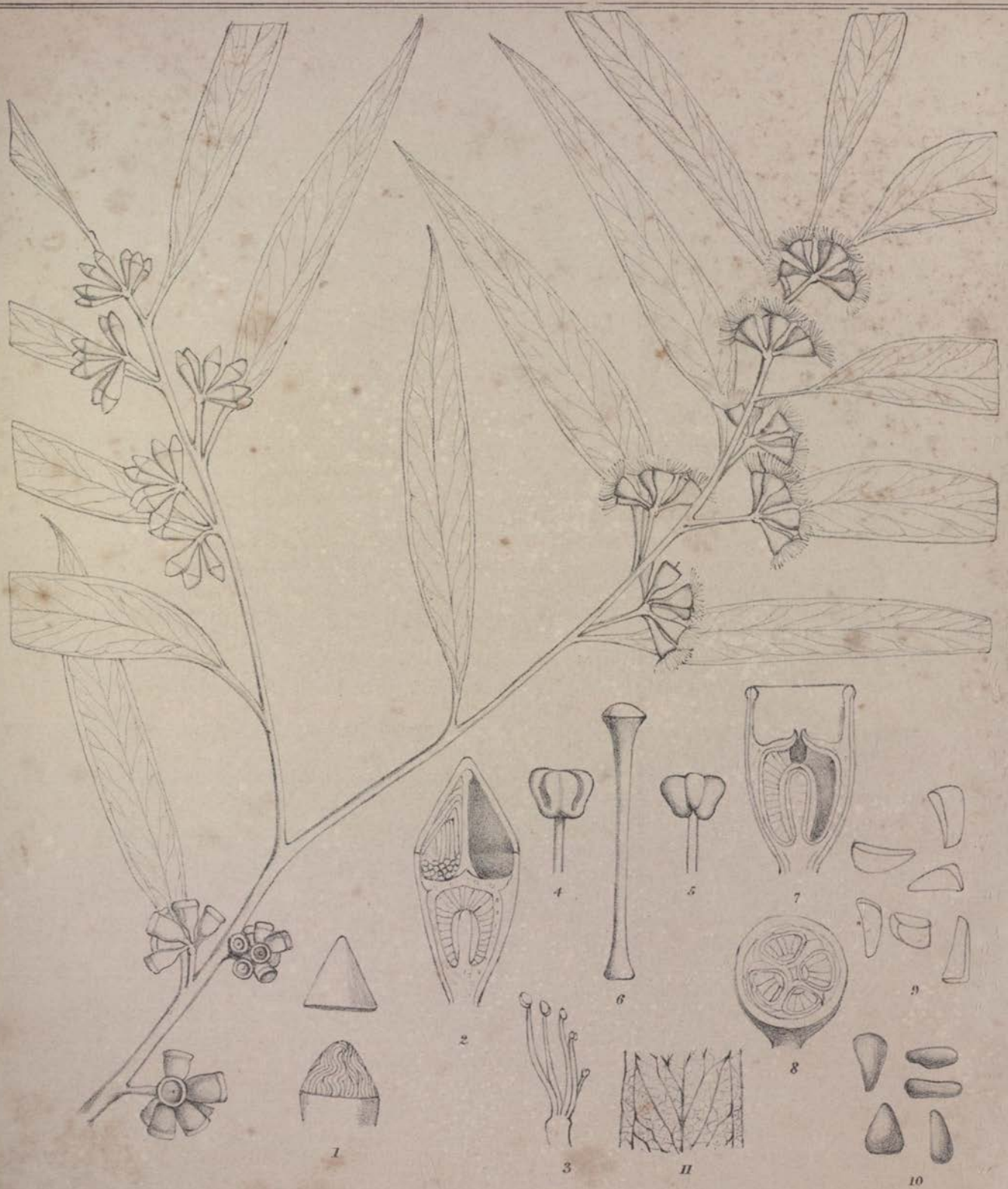
A tree, attaining very considerable height, although flowering already in a dwarf state, called "Wangee" by the natives of the Richmond-River, but Forest-Mahogany by the local colonists according to Mr. Fawcett, and "Tee" by the tribes on the Brisbane-River according to Mr. Bailey. Bark persistent to the utmost branches, lamellar and fuzzy from interwoven and wavy fibres, wrinkled, not much crackling in fire, soft to the touch. Wood very durable, also underground, locally much drawn into use for naves, felloes and spokes, adapted also for lasting railway cross-ties. The foliage is evidently rich in volatile oil, and the chemical and technical properties of this oil should be tested. The general figure of the illustration fairly represents the average dimensions of the leaves, flowers and fruits.

This species pertains to the section of Rhytiphloiæ of the cortical system, unless the bark should prove so fibrous, as to indicate a transfer of this tree to the Pachyphloiæ. Its nearest affinity among the Heterostemones is with E. hæmastoma, with the small variety of which, namely E. micrantha (Candolle prodrom. syst. nat. regn. veg. iii. 217; mémoire des myrtacées t. 5) it shares the minuteness of the calyx-lid, from which the specific appellation of E. microcorys was derived; the bark however is not smooth even on the branches, the leaves are not of equal color on both sides nor shining underneath, besides they are of thinner consistence, while the veins are more spreading and less prominent; indeed, as pointed out by me nearly twenty years ago, the leaves of E. microcorys resemble much those of the West Australian E. marginata, a species in other respects very different. The fruit of E. microcorys is longer and particularly narrower than that of E. hæmastoma var. micrantha, and its terminal border is neither broad nor depressed. In E. paniculata, which in some respects also approaches E. microcorys, the bark is deeply furrowed and not unfrequently (particularly in trees from the desert) much seceding, the leaves are nearly of equal color on both sides, not very shining above and not or less copiously perforated by oil-pores, the stomata are not confined to the lower page although those of the surface are about six times less in number than those beneath, the flowerbuds are thicker, the lid is much more convex and substantial or even gradually pointed, the anthers are dilated upwards and not broader than

long, thus not approaching those of the section Renantheræ, the stigma is distinctly dilated, the fruit is broader, also in proportion to its width shorter and rather suddenly not gradually contracted into the stalklet.

Mr. Fawcett reports, that this is the tallest Eucalyptus-tree of the Richmond-River District, rising to 300 feet height; thus this species, considering also the excellent quality of its timber, ought to attract attention for wood-culture in humid tracts of countries as well in Australia as abroad. No data are hitherto extant, to rate the celerity of growth of the Wangee.

Explanation of Analytic Details.—1, longitudinal section of an unexpanded flower; 2, some sterile and fertile stamens in situ; 3 and 4, front- and back-view of a fertile stamen; 5, style and stigma; 6, longitudinal section of a fruit; 7, transverse section of the same; 8 and 9, sterile and fertile seeds; 10, portion of a leaf; all magnified, but in various degrees.



R.Austen del. et lith. F. v. M. direxit Steam Litho Gov.-Printing Office Melb.

Eucalyptus odorata. *Behr.*

Behr, in Schlechtendal's Linnæa xx. 657 (1847); Miquel, in Nederlandisk Kruidkundig Archief iv. 129 (1859); F. v. M., fragmenta phytographiæ Australiæ ii. 66; Bentham, flora Australiensis iii. 215; E. cajuputea et E. porosa, Miquel, as above quoted, pp. 126 and 132.

Leaves scattered, narrow-lanceolar, rarely broad, often on comparatively short stalks, not much elongated, rather dull-green or somewhat shining, of equal color on both sides; their veins mostly spreading at a very acute angle and not crowded, the two longitudinal veins somewhat removed from the edge; umbels either axillary and solitary or forming short panicles, on short or not much elongated and hardly angular stalks, with 3–9 flowers; calyces rather small, gradually attenuated into short stalklets or the latter occasionally suppressed or seldom conspicuously elongated; *lid from broad-conical to pointed-hemispherical, somewhat shorter than the tube;* stamens all fertile, inflexed before expansion; *anthers minute, roundish, opening by pore-like slits;* stigma slightly dilated; fruit obconic- or bellshaped-semiovate, smooth or faintly marked by angular lines, with compressed vertical margin, 3–5-celled; *valves short, quite enclosed,* converging flatly before expansion; placental axis at least twice as long as broad; seeds very small, without any appendage, the sterile seeds not very narrow.

On limestone ridges along and towards Spencer's Gulf and St. Vincent's Gulf, thence to the Flinders-Ranges (Behr, F. M.), ascending on Mount Brown to 2,000 feet elevation (J. E. Brown).

The precise eastern and also western natural limits of E. odorata have never yet been ascertained, but the species possibly may reach the western boundaries of the colony of Victoria, although it does certainly not extend to Port Phillip.

A middle-sized or rather small tree, with greyish rough hard persistent bark, hence called like many other Eucalypts of such a feature "Box-tree," notwithstanding of their wood bearing not the slightest resemblance to the real tree, from which the Turkish Boxwood for xylography is derived. E. odorata passes also as one of the "Peppermint-trees." The timber is of fair quality, although seldom of the very large dimensions, to which we are accustomed among Eucalyptus-woods; it is very tough and used in a manner like that of E. melliodora; it shows long resistance to decay, when placed underground according to J. E. Brown, but who notes the stems of matured trees frequently hollow. The oil-dots of the leaves are as a rule only partially apparent, or even quite concealed, yet the cajuput-like scent, which suggested the specific name, is strongly enough developed. The anthers of some of the outer stamens are sometimes enlarged and deformed.

In comparison to allied species E. odorata shows much affinity to E. melliodora; the habit of the two trees is much the same, but the former seems restricted to a calcareous soil; the foliage is often less opaque and rather of thicker consistence, the outer stamens are not extensively sterile, the anthers are not so remarkably truncate, the stigma is less broad and the fruits are not distinctly contracted towards the summit. The differences, by which E. odorata can readily be distinguished from E. polyanthema, E. populifolia, E. Behriana and E. pallens, will be pointed out respectively in the descriptive text of these species. Nearest perhaps it approaches to E. largiflorens, which is best distinguished by its usually narrower leaves of thinner consistence with finer and rather more spreading veins, by the more extensively paniculated flowers of smaller size, by the shorter lid often of less width than the tube of the calyx, by the latter more suddenly meeting the stalklet, by smaller more globular and less truncated anthers and by fruits of less size with more contracted orifice and valves close to the summit.

Mr. Otto Tepper (in the Transactions of the Philosophic Society of Adelaide, February 1878) mentions this tree among the South Australian Eucalypts, which become extensively destroyed by the superabundance of a nocturnal Melolontha-Cockchafer, preying on their foliage, after through the disturbing action of herds and flocks, and more so still through the clearings effected for agricultural settlements, the much diminished number of predatory birds and insects can no longer hold this particular Melolontha in check, a species which seems not less destructive than the European May-bug. As other causes of the dying of Eucalyptus-trees in various districts may be mentioned the local increase of the Phalangistæ after the gradual disappearance of the aboriginal hunters; further the destruction of the underwood, involving the exsiccation and by traffic also the induration of the soil, thus preventing access of moisture to the often rather horizontal roots of Eucalyptus-trees, as pointed out in a lecture of mine on "forest-culture in relation to industrial-pursuits" (June 1871). Our Eucalypts furthermore perish often through bush- or forest-fires reckless originated, or through the often unnecessary invasion or even ruthless annihilation of timber-vegetation by agricultural settlers, changes thus being brought about in the clime and shelter, flow of water and the food of native birds, not to speak of the wanton hunt by thoughtless sportsmen after even so many of the insectivorous creatures of our feathered tribe.

Explanation of Analytic Details.—1, upper portion of calyx, the lid severed; 2, longitudinal section of an unexpanded flower; 3, some stamens in situ; 4 and 5, front- and back-view of an anther with part of the filament; 6, style and stigma; 7 and 8, longitudinal and transverse section of a fruit; 9 and 10, sterile and fertile seeds; 11, portion of a leaf; all magnified, but in various degrees.

R. Austen del. C. Troedel & Co Lith. F. v. M. direxit. Steam Litho. Gov. Printing Office, Melb.

Eucalyptus saligna. *Smith.*

Smith, in the Transactions of the Linnean Society iii. 285 (1795); Kippist, in F. M. fragmenta phytographiæ Australiæ ii. 173 (1861); Bentham, flora Australiensis iii. 245.

Tall; branchlets angular; *leaves* scattered, broad- or oftener elongated- or narrow-lanceolar, gradually acuminated, somewhat curved, *paler beneath;* the lateral veins quite numerous, subtle and almost transversely spreading, the two longitudinal veins only slightly or hardly removed from the edge; oil-dots numerous, but much concealed; umbels axillary or lateral, rarely paniculate, on a broadly compressed stalk, consisting of 4–8, rarely 9–13 flowers; calyces on very short thick stalklets or almost sessile, their *tube bellshaped- or turbinate-obconical, about as long as the hemispheric short-acuminated lid,* often faintly biangular; stamens all perfect, inflexed while in bud; anthers oval, opening with longitudinal almost parallel slits; stigma hardly broader than the summit of the style; fruit bellshaped- or conical-semiovate, truncate, 3–5 celled; rim narrow, descendent; *valves short, semiexserted;* seeds without any expanding membrane.

In New South Wales and the most southern part of Queensland, chiefly along banks of sylvan streams, also on the outskirts of forests.

A tree attaining a lofty height, passing locally as Blue-, White-, Grey- or Flooded-Gum-tree; bark grey and smooth from gradual decortication of the outer layers. According to Mr. Fawcett the straightness of the stem renders it fit for spars, while Dr. Woolls calls the wood splendid and states, that it is largely utilized for ship-building; other data pronounce it an inferior wood, and this discrepancy may be reconciled by local diversities of the ground, from which the particular timber was obtained. This species differs from E. resinifera, irrespective of the nature of its wood, in the almost complete smoothness of its bark, smaller flowers and fruits both on shorter stalklets, proportionately abbreviated lid, style and valves, and not distinctly ring-like rim of the fruit.

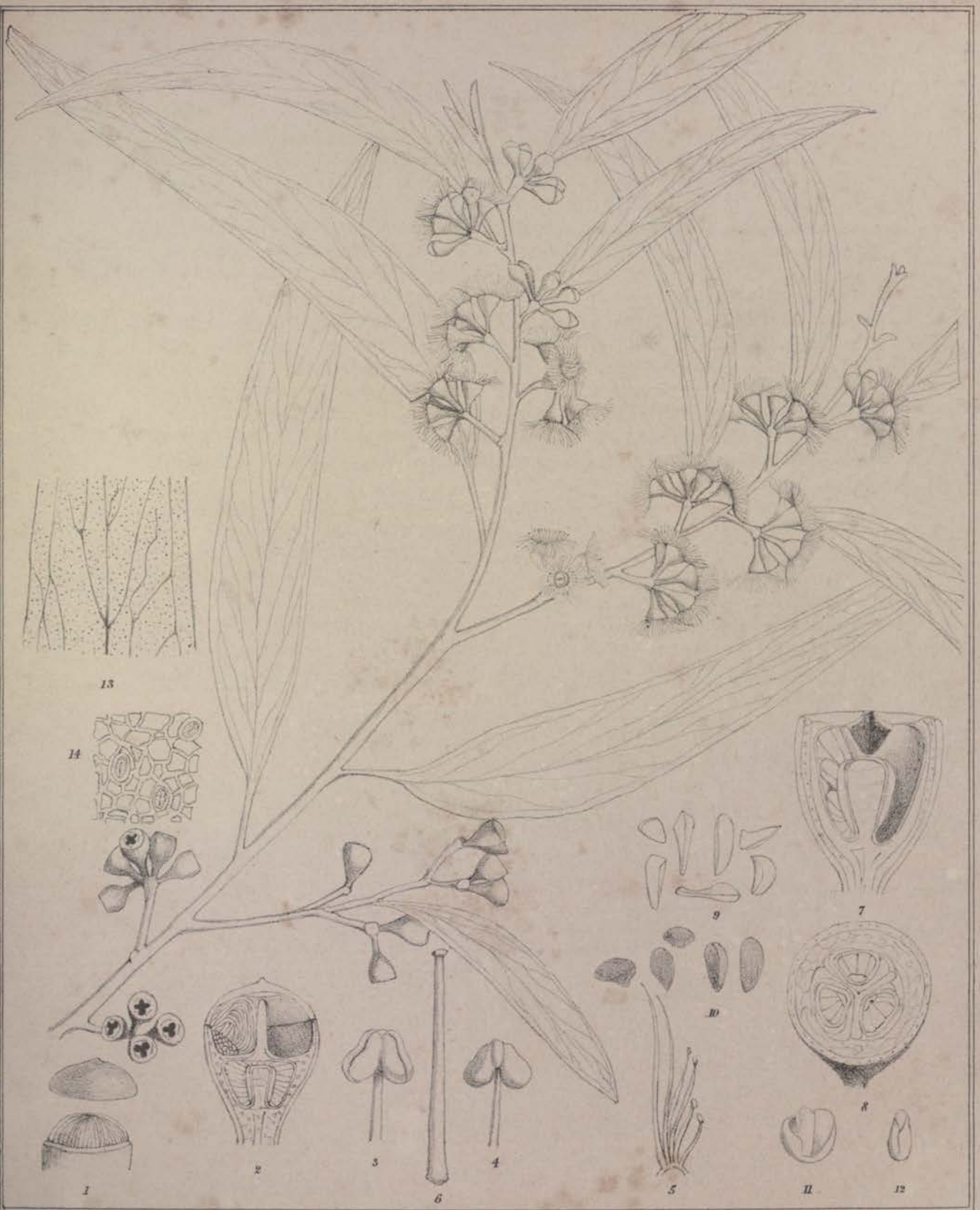
Somewhat longer and besides narrower fruits occur, than those here illustrated, others again more top-shaped. The lid is occasionally also more pointed, than shown in our lithogram. The calyces are usually shining, more rarely tinged with a whitish bloom. The leaves in the drawing, as now printed, have obtained an appearance rather too prominently veined; moreover the secondary veins render in reality the primary venation closer, than given in our plate. The bark is more or less shining, but rough old layers may persist up to a dozen feet at the base of the stem. The Rev. Dr. Woolls (Contributions to the Flora of Australia, p. 237, anno 1867) saw stems, attaining 7 feet in diameter, found the tree growing rapidly and mentions the specific gravity of the wood as less than that of most other Eucalypts. The occurrence of this tree indicates good soil.

The founder of the Linnean Society, when establishing this species, attributed to it narrower and thinner leaves and smaller flowers than those of any other species known at the time (viz., E. robusta, E. pilularis, E. tereticornis, E. resinifera, E. capitellata, E. botryoides, E. hæmastoma, E. piperita, E. obliqua, E. corymbosa, E. paniculata), but this remark does not apply to the more general state of this tree, as figured here. The specific appellation is supposed to allude to the resemblance of the leaves to those of some willows, but this similarity is not sufficiently marked to be acceptable for a vernacular name.

I am not certain of the form of the leaves characteristic of the seedlings of this species in the first and second year of their growth; their shape should be studied at all available opportunities; observations to this effect, commenced by me in the Botanic Garden, came long since to an abrupt close, and could since methodically not yet be resumed.

The brief diagnosis, offered by Sir James Smith, did not admit of recognizing fully the extent of variability of either E. saligna or E. resinifera; thus arose many years ago E. hemilampra, referred by Bentham to the latter species, but according to the smoothness of the stem referable to E. saligna. This variety produces flowers on long stalklets and an elongated lid like that of E. tereticornis. The differences between E. saligna and E. botryoides are habitually very great on account of their respective bark, thin, smooth and pale in the one, thick, rough and dark in the other; but the characteristics of the flowers and fruits are far less marked, being almost reduced in E. botryoides to a shorter and blunter lid, an usually more angular tube of the calyx and retracted totally enclosed valves of the fruit. Thus the Blue Gum-tree of the Brisbane-River is not E. botryoides but E. saligna. Bees are fond of the flowers of this particular Eucalypt, as indeed of those of many other congeners. The unreliability of the colonial names for most of our timber-trees is again glaringly demonstrated in this instance; and if a particular not general aboriginal name could be ascertained for this species, it would certainly be deserving of preference. The comparative ratio of growth of this tree should be noted, with a view of learning, whether it would be recommendable as one for forest-culture, with the prospect of early remunerative gain.

Explanation of Analytic Details.—1, top of calyx, the lid removed; 2, longitudinal section of unexpanded flower; 3 and 4, front- and back-view of anther: 5, stamens; 6, pistil; 7, longitudinal section of fruit; 8, transverse section of fruit; 9, sterile seeds; 10, fertile seeds; 11, portion of leaf; all magnified but variously.



R.Austen del. et Lith. F. v.M. direxit. Steam Litho. Gov. Printing Office Melb.

Eucalyptus Sieberiana. *F v M.*

E. virgata, Sieber, in Sprengel systema vegetabilium, curæ posteriores 195 (1827); Candolle, prodromus systematis naturalis regni vegetabilis iii. 217 (1828); Bentham, flora Australiensis iii. 202; Spicer, Handbook of the Plants of Tasmania, 149 (1878).

The "Yowut." Finally tall; leaves scattered, sickleshaped-lanceolar, shining and nearly of equal color on both sides, more or less transparently dotted; *their lateral veins more longitudinal than transverse and faint*, the intramarginal vein somewhat removed from the edge or evanescent; umbels mostly solitary with 10–4 flowers, rarely still fewer; *flowerstalk usually strongly compressed; lid of the calyx hemispheric*, quite blunt or oftener slightly pointed; tube of the calyx short, almost semiglobular, but attenuated into a rather thick short or not much elongated stalklet, slightly or doubly longer than the lid; stamens inflexed while unexpanded; *outer stamens sterile*, with imperfect or without anthers; fertile anthers almost kidneyshaped, pale; stigma not dilated; fruit semiovate and somewhat pearshaped, 3- or sometimes 4- rarely 5-celled, its rim depressed or quite flat, seldom through descent narrowed; *valves deltoid, very short*, convergent, usually affixed very close to the summit of the fruit; seeds without any appendage, the sterile rather short, but often comparatively broad.

In the forests towards the Upper Yarra-waters and of Gippsland, ascending to 4,000 feet elevation, extending along the Genoa up to the White Rock Mountains (F. M.), scattered along the coast-regions of New South Wales (Kirton), passing on to the Blue Mountains, ascending in the silurian formation the Dromedary-Ranges to 1,500 feet (Wilkinson), occurring also on low moist sandy tracts between the Glenelg-River and Mount Gambier and Lake Bonney (Dr. Wehl), reappearing in Tasmania, frequent there on granitic coast-ridges and in valleys of rather sandy or stony soil as well as on slate-hills, from Falmouth to George's Bay, occurring also on hills of the sandstone-formation north of St. Mary (Bissill, Simson) and on East Mount Field at elevations of from 1,000 to 1,500 feet (F. v. M.).

A lofty tree (height 150 feet or even more), with a straight stem, which attains 5 feet in diameter, but in the cripply Stringybark-forests near Lake Bonney dwarfed to 10 or 12 feet, though amply flowering. The trunk, to use Mr. Wilkinson's words, covered with *deeply furrowed bark* of dark-brown color, resembling that of Ironbark, but not so hard, nor so solid, nor so fibrous as that of the typical Stringybark. *Branches smooth* and pale. Mr. Simson calls the bark of the stem very thick and very rough, scored down with seams, not to be pulled off like Stringybark. On account of its much furrowed stem-bark the tree is called in Tasmania "Ironbark-tree," or on account of the smooth limbs "Gumtop" Eucalyptus, by which name it is also known at Wilson's Promontory. At Twofold Bay and Berrima (Woolls) it passes as "Mountain Ash" and in some other places still more perplexing names are bestowed on this tree. Hence it seems best to adopt the name of "Yowut" for it, by which, according to Mr. Howitt, it is known among the Gippsland-tribes. The specific appellation now offered is also a new one, inasmuch as the original adjective "virgata" is very misleading, because only under very exceptional circumstances is this usually tall timber-tree reduced to a virgate or twiggy state; neither is there anything streaked or striped about the stem to justify the designation virgate in an other sense of the word. Moreover De Candolle and Sprengel attribute to Sieber's plant a conical lid of the length of the calyx-tube, and such more frequently was also seen by Bentham, but this is not in consonance with the ordinary state of E. Sieberiana as now here defined, and may apply to a different species.

The trunk is sawn into good timber, and it is also used for posts and rails ; wood among other purposes recommended for shafts ; it resembles much more that of our Blue Gum-tree, than that of our Stringybark-trees ; it is hard and when seasoned difficult to cut, but burns well even when fresh. Mr. A. W. Howitt finds the wood of superior quality, light, tough and elastic, used for swingle-trees of buggies, ploughs &c., but it will not endure underground. Mr. Simson further observes, that this species is more branching than any other Tasmanian Eucalypt, very often going off into several large limbs at 20 feet or even less.

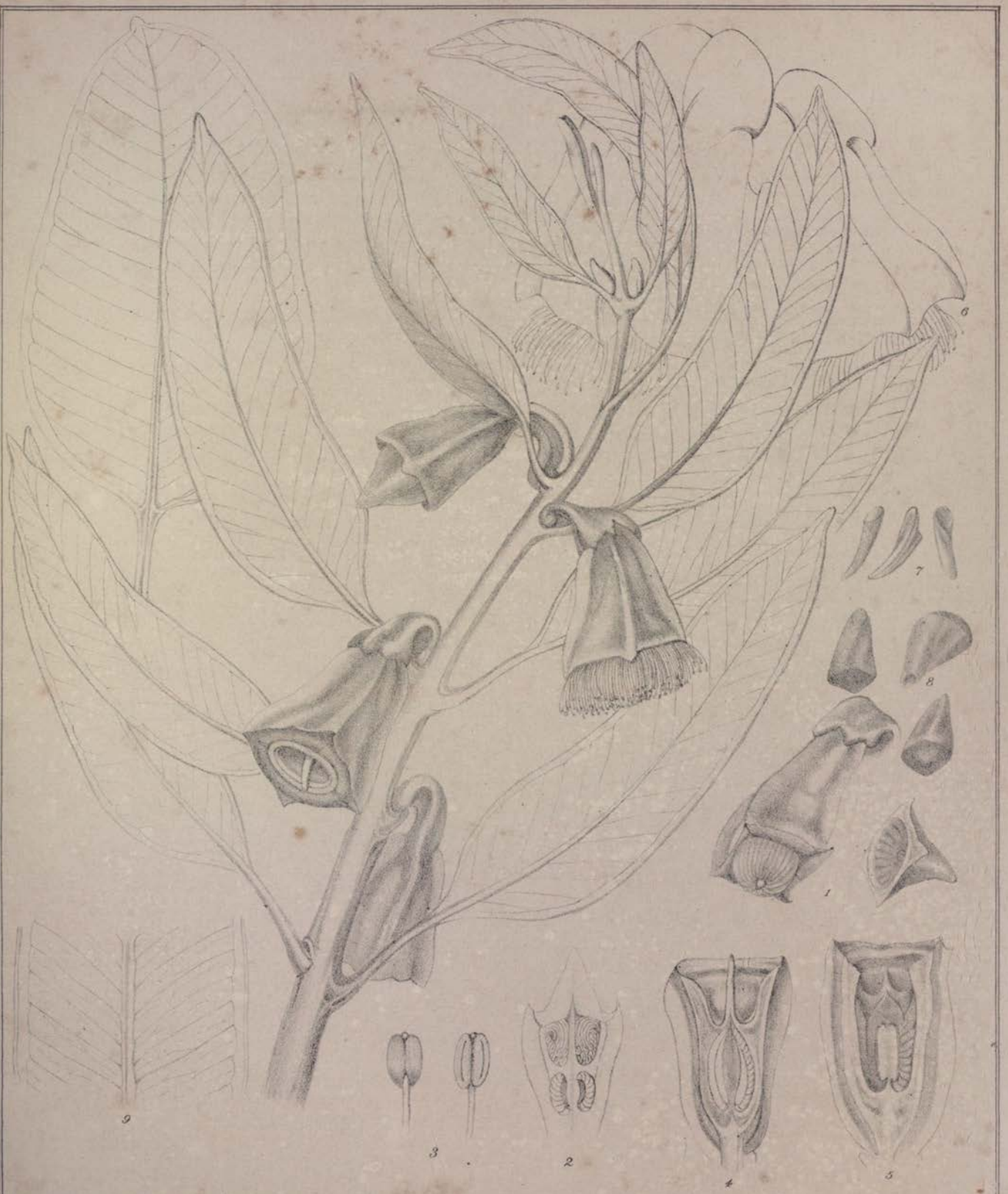
The nearest affinity of E. Sieberiana rests clearly with E. hæmastoma, but the stem-bark of the former is far more ridged than that of the latter ; the veins of the leaves are less spreading and also less prominent, while the fruit is usually longer, more exactly semiovate and never verging towards an hemispheric form ; the red rim of the fruit, significant of the name of E. hæmastoma, can also often be observed in E. Sieberiana. The width of the flowerstalk is evidently variable, indeed occasionally it is hardly compressed. E. Sieberiana differs from E. pauciflora, Sieb. (E. coriacea, Cunn.), in the persistency of the stem-bark, in the leaves hardly so shining and not quite so thick, the veins less prominent and also less longitudinal, and not several veins starting together from the base of the leaves, in the flowerstalks nearly always compressed, in the stamens not being all or nearly all fertile, in rather smaller anthers, smaller fruits often conspicuously longer than broad on generally more extended stalklets.

The differences, by which E. Sieberiana is distinguished from E. obliqua, are obvious, consisting in the less fibrous and more rugged bark, not coating branches as well as stem as in the latter species, in the less fissile wood, the rather finer veins of its leaves, usually more dilated flowerstalks, the stamens only partially fertile, the fruits upwards less contracted, with a much broader rim, usually less suddenly tapering into the stalklets and valves not so deeply inserted.

The Rev. W. W. Spicer, M.A., in his meritorious "Handbook of the Plants of Tasmania," published last year, refers at page 149 first to this Eucalypt as Tasmanian.

The traveller Franz Wilhelm Sieber of Prague secured for botanical science this Eucalypt with many other plants of New South Wales in 1823, while collecting for several months in that colony.

Explanation of Analytic Details.—1, upper portion of calyx, the lid lifted ; 2, longitudinal section of a flowerbud ; 3 and 4, front- and back-view of an anther ; 5, sterile and fertile stamens in situ ; 6, style with stigma ; 7, longitudinal section of fruit ; 8, transverse section of fruit ; 9 and 10, sterile and fertile seeds ; 11, embryo uncoiled ; 12, embryo in its natural position ; 13, portion of a leaf ; 14, pellice with stomates, the latter very much magnified ; the other figures moderately but variously enlarged.



Tod. del. C. Troedel & Cº Lith. F. v M. direxit. Steam Litho Gov. Printing Office, Melb.

Eucalyptus tetraptera. *Turczaninow.*

Turczaninow, in Bulletin de la Société des naturalistes de Moscou, 1849, part ii. 22; F. v. M., fragmenta phytographiæ Australiæ ii. 34; Bentham, flora Australiensis, iii. 228; E. acutangula, Turczaninow, in Bulletin de l'academie des sciences de Petersbourg 1852, p. 418.

Shrubby, branchlets very robust; leaves scattered, of exceedingly thick consistence, oblong- or sickleshaped-lanceolar or less commonly oval, shining on both sides; veins very subtle, the peripheric vein slightly distant from the margin; *flowers very large, axillary, solitary, on a recurved flat and very broad stalk; tube of the calyx almost obverse-pyramidal, sharply quadrangular, broader than the pyramidal-conical lid* and considerably longer, each of the angles of the tube produced at the apex into a short tooth; stamens red, inflected in the bud; anthers oval, terminated by a black-purple gland, opening with longitudinal slits; stigma hardly broader than the style; fruit bellshaped-quadrangular or sometimes only with two angular ridges; placental axis about twice as long as broad; valves four, deltoid, well enclosed; seeds without any broad membranous appendage.

From the Fitzgerald-River dispersed to near Cape Le Grand and Mount Rugged, particularly on granitic hills (Drummond and Maxwell).

A shrub, seldom exceeding 10 feet in height. Branchlets either almost cylindrical or prominently quadrangular. Leaves usually 3–5 inches long, attaining however exceptionally a length of nearly a foot, very rigid, hence the oil-glands buried and concealed; the lateral veins copious and parallel. Flowers almost pendent; their stalk shorter than the tube of the calyx, attaining occasionally a breadth of nearly $\frac{3}{4}$ inch; stalklet none. Tube of the calyx about $1\frac{1}{2}$ inch long, smooth, not rarely assuming a reddish hue; lid somewhat wrinkled, scarcely exceeding $\frac{1}{2}$ an inch in length, quadrangular. Anthers purplish; pollen very pale, not yellow. Style exceeded in length by the stamens. Fruits attaining up to 3 inches in length, very woody; their rim concave. Sterile seeds variable in width, but usually much more slender than the fertile seeds.

This singular species, one of the most ornamental of the genus, was introduced by me into the Melbourne Botanic Garden about twenty years ago, and from thence abroad. It remained during lengthened culture of shrubby size.

This affords an apt opportunity of alluding to the other species with remarkably large fruits, although E. tetraptera is not closely akin to any of them in its characteristics. They are E. miniata and E. ptychocarpa from Carpentaria and Arnhem's Land; E. Watsoniana and E. Abergiana from Eastern Queensland; E. Preissiana, E. pyriformis, E. erythrocorys, E. macrocarpa, E. ficifolia, E. calophylla and E. Youngiana from South-West Australia, where evidently the kinds with fruits of very conspicuous size are more extensively represented than elsewhere. E. megacarpa and E. buprestium offer also rather large-sized fruits, surpassing not rarely those of E. globulus.

For ornamentation in shrubberies E. tetraptera is perhaps still more eligible than E. pyriformis, E. Preissiana, E. erythrocorys and E. macrocarpa, though these shrubs only in their floral beauty can rival with E. miniata, E. phœnicea and E. ficifolia, but not in the tall grandeur of the three last-mentioned species. The purple-flowered variety of E. Leucoxylon ranks also quite as ornamental and so E. cornuta and especially the closely allied E. Lehmanni.

Explanation of Analytic Details.—1, unexpanded flower, lid separated; 2, longitudinal section of an advanced flowerbud; 3, back- and front-view of a stamen; 4, longitudinal section of a young fruit; 5, longitudinal section of a half-ripe fruit; 6, flowers of a large variety; 7 and 8, sterile and fertile seeds; 9, portion of a leaf; 1, 2, 4, 5 and 6, natural size; 3, 7, 8 and 9, variously magnified.

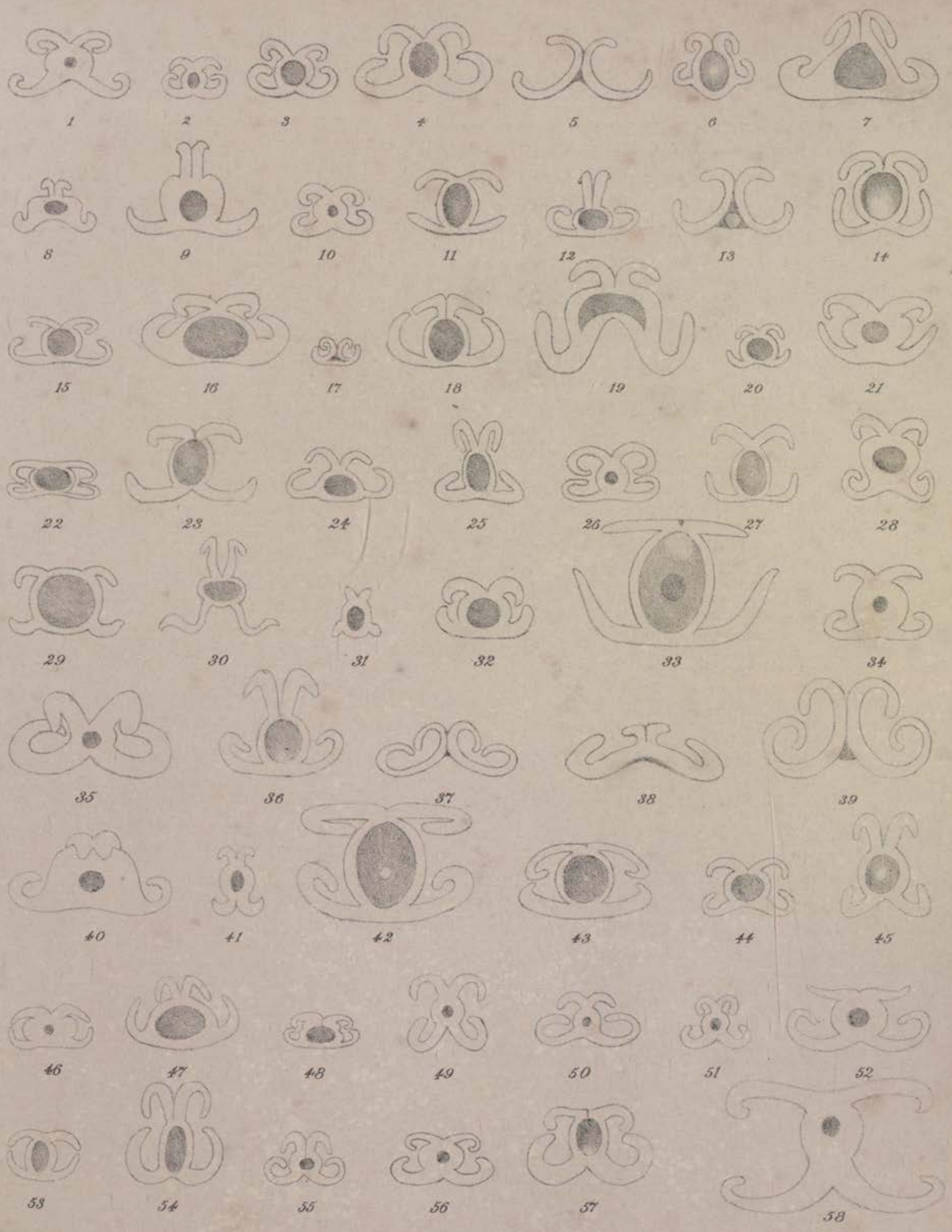
EUCALYPTUS TETRAPTERA.

The bye-following lithographic plate presents transverse anther-sections of many Eucalypts, pertaining to Bentham's series "Normales" (Parallelantheræ), to which also E. tetraptera belongs. These lithograms give readily an idea of the relative width, the distances of the dehiscence-lines and the curvature of the valves, peculiar to the anthers of the respective species; and thus also at a glance the size and form of the connective may be contrasted. In a similar manner hereafter sections of the Renantheræ, Heterostemones, Porantheræ and Micrantheræ will be provided, to be followed by full drawings of the anthers of many different species of all the series, side by side.

Transverse Sections of Anthers of various Eucalypts.

(Series: Normales; diametric augmentation 28 times.)

1. Eucalyptus Abergiana, F. v. M.
2. aspera, F. v. M.
3. botryoides, Sm.
4. calophylla, R. Br.
5. concolor, Schauer.
6. conoidea, Benth.
7. cornuta, Lab.
8. corymbosa, Sm.
9. cosmophylla, F. v. M.
10. dealbata, Cunn.
11. decurva, F. v. M.
12. diversicolor, F. v. M.
13. Doratoxylon, F. v. M.
14. Drummondi, Benth.
15. dumosa, Cunn.
16. erythrocorys, F. v. M.
17. eudesmioides, F. v. M.
18. falcata, Turcz.
19. ficifolia, F. v. M.
20. fœcunda, Schauer.
21. globulus, Lab.
22. gomphocephala, Cand.
23. goniantha, Turcz.
24. goniocalyx, F. v. M.
25. grossa, F. v. M.
26. Gunnii, J. Hook.
27. incrassata, Lab.
28. latifolia, F. v. M.
29. Lehmanni, Preiss.
30. Eucalyptus longifolia, Link.
31. loxophleba, Benth.
32. macrandra, F. v. M.
33. macrocarpa, Hook.
34. maculata, Hook.
35. miniata, Cunn.
36. occidentalis, Endl.
37. pachyloma, Benth.
38. patens, Benth.
39. Preissiana, Schauer.
40. ptychocarpa, F. v. M.
41. pulverulenta, Sims.
42. pyriformis, Turcz.
43. redunca, Schauer.
44. resinifera, Sm.
45. robusta, Sm.
46. rostrata, Schlecht.
47. rudis, Endl.
48. saligna, Sm.
49. setosa, Schauer.
50. Stuartiana, F. v. M.
51. tereticornis, Sm.
52. terminalis, F. v. M.
53. tetragona, F. v. M.
54. tetraptera, Turcz.
55. vernicosa, J. Hook.
56. viminalis, Lab.
57. Watsoniana, F. v. M.
58. Youngiana, F. v. M.



J. Rummel del. C. Troedel & Cº Lith. F. v M. direxit. Steam Litho. Gov. Printing Office Melb.

Eucalyptus - Anthers, *transverse sections*

EUCALYPTOGRAPHIA.

A DESCRIPTIVE ATLAS

OF THE

EUCALYPTS OF AUSTRALIA

AND THE

ADJOINING ISLANDS;

BY

BARON FERD. VON MUELLER, K.C.M.G., M. & PH.D., F.R.S.,

GOVERNMENT BOTANIST FOR THE COLONY OF VICTORIA.

"NON SUCCIDES ARBORES, NEC SECURIBUS DEBES VASTARE EARUM REGIONEM."—*Liber Deuteronomii* XX. 19.

THIRD DECADE.

MELBOURNE:

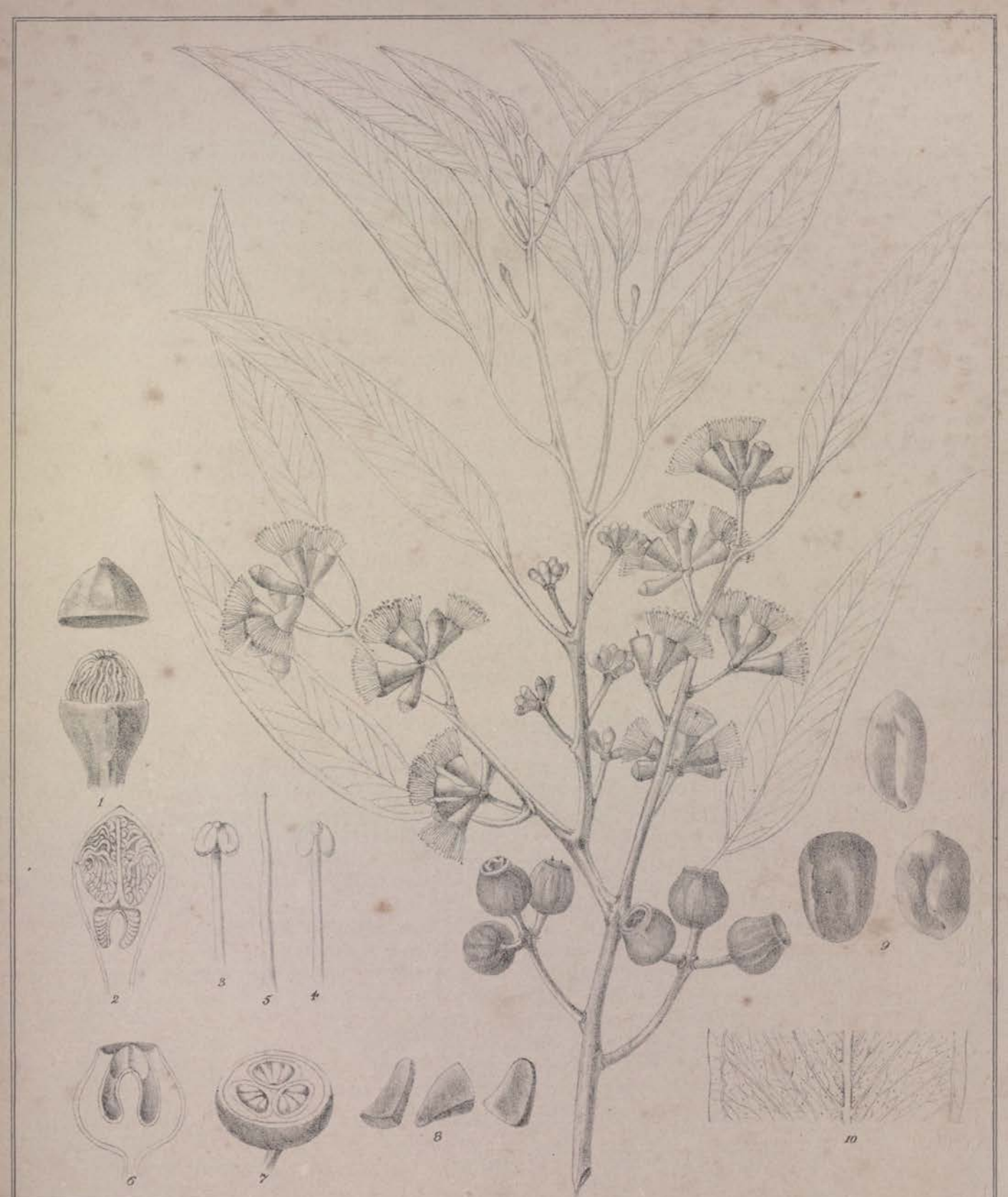
JOHN FERRES, GOVERNMENT PRINTER.

PUBLISHED ALSO BY GEORGE ROBERTSON, LITTLE COLLINS STREET.

LONDON:

TRÜBNER AND CO., 57 AND 59 LUDGATE HILL; AND GEORGE ROBERTSON, 17 WARWICK SQUARE.

M DCCC LXXIX.



Tedt. del. C. Troedel & Cº Lith.

F. v. M. direxit.

Steam Litho Gov. Printing Office, Melb.

Eucalyptus Baileyana. *F v M.*

EUCALYPTUS BAILEYANA. 21

F. v. M., fragmenta phytographiæ Australiæ xi. 37 (1878).

Finally tall; branchlets angular towards the summit; leaves scattered, of thin consistence, sickleshaped-lanceolar, somewhat shining, of equal green on both sides, copiously dotted; their veins moderately spreading, very thin, the circumferential vein somewhat removed from the edge; umbels lateral and axillary, solitary or some short-paniculate and terminal, with 5–10 or rarely 3–4 flowers; stalks slightly angular; stalklets short and thick; tube of the calyx almost semiovate, not angular, not much longer than the nearly hemispheric lid, both not shining; stamens all fertile, inflexed before expansion; *anthers broadly cordate*, opening by divergent slits; stigma not dilated; *fruits rather large, globular-urnshaped, 3-celled; margin of the orifice thinly compressed; valves deltoid, slightly exserted* or hardly extending beyond the orifice; seeds without any appendage.

On poor somewhat sandy ridges near Moreton-Bay with E. Planchoniana; Bailey.

A tree attaining fully 150 feet in height, the stem rising up to 50 feet, with a diameter seldom exceeding 4 feet. Bark fibrous, persistent as well on the branches as on the stem, the inner portion tough and yellowish. Wood also of a yellow tinge, according to the discoverer, Mr. F. M. Bailey, through whose active zeal and gift for observing discrimination we are made acquainted during later years with so many additional data concerning the rich vegetation of Queensland. Mass of foliage dense and shady.

From the above note it will be observed, that this is one of the Stringybark-trees, though very distinct from any others of that group, namely E. acmenoides, E. capitellata, E. marginata, E. macrorrhyncha, E. obliqua, E. piperita, E. Stuartiana, E. tetrodonta, to which may be added the typical E. amygdalina with persistent bark, irrespective of some smaller species, which cannot properly be counted among timber-trees. The wood is tough and durable and sought for various implements, such as tool-handles, also for posts and rails.

E. Baileyana differs from E. Bowmanii in the following respects: the leaves are more shining, of a darker green, of a thinner consistence, more distinctly and less divergently veined, while the copious oil-dots are very visible; the flowers are smaller and distinctly provided with stalklets, whereas the stalks of the umbels are not broadly compressed; the lid is much shorter and not semiovate-conical; the anthers are broader, indicating an approach to the Renantheræ, thus the slits of their cells are evidently divergent and not almost parallel, while the terminal gland of the anthers is more obvious; further the style is thinner and the stigma smaller. The comparison of these two species cannot be extended to its carpologic characteristics, the fruit of E. Bowmanii still remaining unknown, the latter species not yet having been refound anywhere in Queensland since the death of the lamented finder. The tree from Port Denison, alluded to under E. Bowmanii by Bentham (flora Australiensis iii. 220) belongs to E. drepanophylla. The last-mentioned species (F. M., in Bentham's flora Australiensis iii. 221) when compared with E. Baileyana has narrower leaves of a paler hue, with more numerous and also more spreading veins, without easily discerned pellucid oil-dots; the stalklets are thinner; the anthers are roundish, with nearly parallel cells like those of E. Bowmanii, while the fruit is totally different, being small, semiovate, with half-emerging valves.

The only other species, with which E. Baileyana could perhaps be confused, is E. trachyphloia (F. M., in the Journal of the Linnean Society iii. 221; Bentham, flora Australiensis iii. 221; F. M., fragmenta phytographiæ Australiæ xi. 43); its leaves are paler beneath and their veins very

divergent and copious; the stalklets are thin; the lid is much smaller and exceeded in width and still more so in length by the tube of the calyx, separating moreover by an irregular rupture and not a clearly defined circumcision; the anthers are ovate, whereas the fruit is much smaller, nearly twice as long as broad with deeply enclosed valves. Finally it may be observed, that E. Baileyana exhibits great resemblance to E. eugenioides both in leaves and flowers, although the fruits are so very decidedly different and resemble those of E. dichromophloia.

The Kino of this species contains about 35 per cent. gum.

Explanation of Analytic Details.—1, unexpanded flower, the lid lifted; 2, longitudinal section of an unexpanded flower; 3 and 4, front- and back-view of a stamen; 5, style and stigma; 6 and 7, longitudinal and transverse section of a fruit; 8, seeds; 9, portion of a leaf; all magnified, but in various degrees.

R.Austen del. et lith.

F. v. M. direxit.

Steam Litho: Gov. Printing Office, Melb.

Eucalyptus capitellata. *Smith.*

EUCALYPTUS CAPITELLATA. 22

Smith, in White's Journal of a Voyage to New South Wales, 216 (1790); Smith, a Specimen of the Botany of New Holland 42 (1793); Transactions of the Linnean Society iii. 285 (1797); Wendland, collectio plantarum, t. 36; De Candolle, prodromus systematis naturalis regni vegetabilis iii. 218; Kippist, in F. M. fragmenta phytographiæ Australiæ ii. 173; E. piperita, Reichenbach, Magazin der æsthetischen Botanik, t. 42, according to Bentham.

Head-flowered Stringybark-tree. Finally tall; leaves scattered, elongate- or sickleshaped-lanceolar, of comparatively thick consistence, shining on both sides and often more intensely so on the upper page, dark-green, usually very inequilateral towards the base; oil-dots copious, mostly concealed; the lateral veins moderately spreading, the intramarginal vein distinctly removed from the edge; *umbels capitate*, lateral or axillary, solitary or some paniculate, on angular or almost cylindrical stalks, bearing from 4 to 15 flowers not of large size; stalklets none or exceedingly short; *tube of the calyx semiovate-obconical, angular*, from hardly longer to about twice as long as the hemispheric or convex-conical lid, not very much attenuated at the base; stamens all fertile, inflexed while unexpanded; anthers broadly cordate or somewhat kidney-shaped; stigma not broader than the apex of the style; *fruit-calyx almost hemispherical, with an amply protruding convex vertex;* valves wholly exserted, 4 or sometimes 3 or 5, deltoid, hardly as long as or shorter than the width of the rim, the latter rarely flat; the sterile seeds mostly not very narrow, all without any appendage.

From the southern parts of New South Wales to Gippsland, as well in the shore-regions as in mountain-elevations, occurring westward at least as far as Lake Bonney.

From a flowering branchlet, destitute of fruit, sent by Dallachy, it would appear that E. capitellata extends northward to Rockingham's Bay. Bark stringy, outside greyish, persistent, reaching far up the branches, the branchlets alone smooth. The tree attains a maximum-height of about 200 feet, but as a rule is less tall. Near the south-eastern borders of South Australia it occurs, as first observed by Dr. Wehl, often in a cripply state, forming dwarf forests on moist sandy ridges or occurring even in the wet Melaleuca-flats or so-called Teatree-swamps. It furnishes a good timber for splitting and all such other purposes, for which Stringybark-wood is drawn into use.

E. capitellata may occur still further westward, but the distinction of the closely allied E. santalifolia from the vicinity of St. Vincent's Gulf, Spencer's Gulf and even the eastern country of the Great Bight, is as yet not clearly established.

The young seedlings are rough from glands beset with minute tufts of hair; the leaves then are at first opposite, but soon scattered, seated on very short stalks; they are of a narrow oblong-lanceolar form and darker above, thus indicating their horizontal expansion in the early youth of the plant. The number of stomata on the pages of the leaves in upgrown trees is not about equal, as in E. macrorrhyncha, there being often considerably more on the underside than on the surface. From the last-mentioned species, to which it is closely allied, it differs further in mostly smaller flowers, in the blunt or less pointed and generally shorter lid of the calyx, and in the tube of the calyx being visibly angular and not narrowly attenuated into a stalklet. The extending convex vertex of the fruit separates E. capitellata and E. macrorrhyncha from all other tall Stringybark-trees. E. eugenioides approaches also closely to E. capitellata, differing chiefly in somewhat narrower leaves of less rigidity, equally shining on both sides, with the oil-dots often more perspicuous, in the calyces being often rather distinctly attenuated into a short stalklet, in the lid usually more pointed and in proportion to the calyx tube also more elongated, in the fruits

generally smaller, more truncated and with narrower rim; when the latter occurs broader, then the similarity of the fruit-calyx to that of E. hæmastoma becomes more obvious. On the whole E. eugenioides seems as much allied to E. capitellata as to E. piperita; and although the latter species is more similar in leaves and flowers, it appears to be always quite different in fruit, reminding in the narrowness of the rim as well as in the enclosed fruit-valves rather of E. obliqua. The variety brachycorys, doubtfully referred by Bentham to E. macrorrhyncha, from New England (near Timbarra) at elevations of about 2,000 feet, may possibly be a form of E. capitellata, with which it shares the blunt lid, though the calyces are attenuated into distinct and slender stalklets; but the bark of this tree, though stringy, is said to be separating in patches, and curiously enough the tree is locally called Spotted Gum-tree. The fruits are rather more depressed. Expanded flowers remained unknown.

This species might with advantage be reared in wet sand-lands.

Although the recognition of the Eucalypts, as among the most important of trees for Hardwood-culture, belongs only to the researches of the second half of the present secular period, still nearly all the most celebrated species of this genus, though the most extensive of that of timber-trees in the whole British Empire, became descriptively known in phytographic science already at the end of the last and at the beginning of the present century! So it was with the species here now anew defined and with E. obliqua, on which the genus was established, among leading Stringybark-trees;—so with E. tereticornis, which includes as a variety our famous Red Gum-tree,—so with E. marginata, yielding the almost imperishable Yarrah-timber,—so with E. globulus, our Blue Gum-tree of unparalleled celerity of growth among Hardwood-trees,—so with E. amygdalina, which (with E. diversicolor) ranks as probably the loftiest of all trees of the globe! The long neglect of trees of such marvellous value, must now-a-days appear to us almost unaccountable and enigmatical.

Explanation of Analytic Details.—1, summit of calyx, lid detached; 2, longitudinal section of a flowerbud; 3 and 4, front- and back-view of anther; 5, style; 6, longitudinal section of fruit; 7, transverse section of fruit; 8 and 9, sterile and fertile seeds; 10, embryo; 11, the same uncoiled; 12, portion of a leaf; all but variously magnified.

Sulz del. et Troedel & Co Lith.

F.v.M. direxit.

Steam Litho dor Printing Office Melb

Eucalyptus gracilis *F.v.M.*

EUCALYPTUS GRACILIS. 2.

F. v. M., in the Transactions of the Victorian Institute i. 35 (1854); Miquel in Nederlandisk Kruitkundig Archiev iv. 124; F. M., fragmenta phytographiæ Australiæ ii. 55; Bentham, flora Australiensis iii. 211; E. calycogona et E. celastroides, Turczaninow in Mélanges biologiques tirés du Bulletin physico-mathématique de l'académie imperiale des sciences de St. Petersbourg, tome i. 417.

Shrubby or somewhat arborescent; *leaves* scattered, on rather short stalks, *narrow- or almost linear-lanceolar*, not very long nor very inequilateral, slightly curved, of equal color and shining on both sides, *their veins extremely subtle* or hardly visible, not very spreading, the circumferential vein somewhat removed from the margin of the leaf; oil-dots often dark and their transparency concealed; umbels axillary and solitary or some few terminal and almost paniculated, on thin and rather short stalks, with usually 4–8 comparatively small flowers; *tube of the calyx obconical, lined with* 3–5 *longitudinal angles*, attenuated into a usually very short stalklet, considerably longer than the hemispherical or pyramidal-conical lid; *outer stamens sterile*, all the filaments crisped and strongly inflexed before expansion; *anthers very minute, roundish or verging into a kidneyshaped form, opening with lateral pores;* stigma hardly dilated; fruit rather small, semiellipsoid or somewhat obconical or slightly urnshaped, faintly angular, 3- or oftener 4-celled; *rim thin; valves deltoid, enclosed;* seeds without appendage, the sterile much smaller than the fertile seeds.

From the Mallee-country on the Rivers Murray and Darling and their lower tributaries to South-West Australia, particularly in sandy but also in clayey and calcareous soil. Several stems usually from one root, flowering occasionally at a height of about 6 feet, but in the course of years rising finally to 25 feet. Bark from the secession of the outside layers smooth and almost silvery-grey or whitish. Leaves, like those of most Eucalypts, terminated gradually into a narrow pointed apex. Calyces shining. Sterile filaments much exceeding the length of most of the fertile stamens. Style short. Fruits occasionally semiovate; their valvular summit always flat. Sterile seeds extremely minute.

The exact northern limits of this species have as yet nowhere been ascertained. It forms with E. incrassata, E. dumosa, E. uncinata, E. oleosa and E. paniculata the extensive "Mallee-scrubs" of the extratropical and perhaps Central Australian desert-country, reaching in South- and also West-Australia close to the coast, where however some additional congeners enter into the constitution of the Mallee-vegetation, while in South-East Australia E. Behriana, E. largiflorens and E. corynocalyx may become interspersed.

Either as a variety or perhaps even as a species can be distinguished from E. gracilis an Eucalyptus gathered by the lamented late Monsieur A. Thozet in his last botanical journey to Expedition-Range, during which he became a victim of the paludal fever, to which this excellent man so sadly succumbed. This Eucalyptus, which should bear his name, can be distinguished by its longer leaves, narrow-ellipsoid flowerbuds, smaller, not or less conspicuously angular calyces and also smaller and particularly narrower fruit, irrespective of the size of the tree, which rises to a height of 60 feet, according to Mr. E. Bowman and Mr. P. O'Shanesy, who noticed it near the Mackenzie- and Comet-River.

E. ochrophloia (F. v. M., fragmenta phytographiæ Australiæ ix. 36) is removed from E. gracilis on account of its larger leaves with rather prominent veins and less conspicuous oil-dots, its larger flowers, more pointed lid, fruits of larger size and more tapering into an elongated stalklet, also its outside yellowish bark, which gave rise to its odd vernacular appellation "Yellow-Jacket," by which it is known from the Darling- and Lachlan-Rivers to the Paroo and Warrego.

E. gracilis differs from E. largiflorens in shining leaves not of a greyish hue, more numerous and still finer veins and more perceptible oil-dots, in the numerous sterile stamens, anthers opening laterally, less towards the summit, flowers generally larger, less copiously paniculated, more angular calyx, the lid not rarely pointed, often somewhat larger fruit with not distinctly contracted summit, and also in not extensively persistent bark; but seemingly a variety of E. largiflorens from Northern Queensland exhibits also shining leaves of vivid green. E. paniculata, particularly in its variety fasciculosa, coincides also in many of its characteristics with E. gracilis, with which it is intermingled in the Mallee-scrub; but the leaves are larger, less shining, slightly paler beneath than above, not distinctly dotted, with several times less stomata above than beneath and have the margin slightly recurved as is customary in the species with heterogenous and hypogenous stomata; the circumferential vein is rather nearer to the margin of the leaf, while the lateral veins are more spreading and prominent, the flowers are on the whole larger and mostly paniculated, the anthers truncated and open with terminal pores.

E. uncinata, another of the Mallee-species, is best separated from E. gracilis by its often narrower leaves with more spreading veins, usually still more abbreviated stalklets, not at all angular calyces, less inequality in the length of their tube and lid, not flexuous filaments but all fertile, anthers opening by terminal pores, proportionately longer style, upwards very narrow acutely pointed and partially emersed capsular valves and thicker rim of the fruit, which as a rule is smaller and more roundish.

E. oleosa recedes from E. gracilis in having the veins of the leaves rather more transverse, the marginal vein closer to the edge, the calyces never angular, the lid very seldom shorter than the tube of the calyx, the latter often more suddenly contracted into the stalklet, the stamens all fertile, the anthers opening rather by slits than pores though amply so, the style longer, the fruit more contracted at the orifice with pointed and partly protruding valves, the latter forming a conical summit before expansion and the rim thicker; moreover the bark of E. oleosa remains persistent on aged stems and becomes finally rough.

E. decurva (fragm. phytogr. Austral. iii. 130) is recognized already by its elongated anthers which are very evidently longer than broad opening with parallel narrow slits, quite agreeing with those of genuine species of the series Parallelantheræ; but Bentham's description of E. decurva in the flora Australiensis iii. 249 refers extensively to such varieties of E. oleosa, as verge to E. falcata and E. goniantha, all of which with E. concolor should in the anthereal system be placed close to E. decipiens among the Micrantheræ.

E. dumosa in comparison to E. gracilis can mainly be recognized by the absence or extreme shortness of its stalklets, the calyces not or less angular, the stamens all fertile, larger anthers opening by ample slits and mostly larger fruits. Nearly the same characteristics remove E. incrassata, but that species is besides larger in all its parts, its leaves are broader, the flower-stalks very much flattened, the calyces often furrowed-streaked; both form the transit from the Parallelantheræ to the Micrantheræ.

Explanation of Analytic Details.—1, unexpanded flower, lid lifted; 2, longitudinal sections of unexpanded flowers; 3, sterile and fertile stamens in situ; 4 and 5, back- and front-view of anthers with filaments; 6, style and stigma; 7 and 8, longitudinal and transverse sections of fruits; 9 and 10, fertile and sterile seeds; 11, portion of a leaf; all magnified, but to various extent.

Tab 4 del. G Provost et C.F. Lith.

F.M. direxit.

Steam Litho. Gov. Printing Office, Melb.

Eucalyptus maculata. *Hooker.*

Hooker, icones plantarum t. 619 (1844); F. v. M., fragmenta phytographiæ Australiæ ii. 47; Bentham, flora Australiensis iii. 258; Woolls, contributions to the Flora of Australia 231; E. citriodora, Hooker, in Mitchell's Journal of an Expedition into the Interior of Tropical Australia 235 (1848); F. v. M., fragmenta phytographiæ Australiæ ii. 47 & 174; Bentham, flora Australiensis iii. 257; E. melissiodora, Lindley, in Mitchell's Journal of an Expedition into the Interior of Tropical Australia 235; Bentham, flora Australiensis iii. 254; E. variegata, F. v. M., in the Journal of the Linnean Society iii. 88; E. peltata, Bentham, flora Australiensis iii. 254.

Finally tall; branchlets slightly angular; leaves scattered, elongated- or narrow-lanceolar, often somewhat sickleshaped, seldom more oval, of equal green on either side; their *lateral veins crowded, pinnate-spreading, prominent*, the circumferential vein very close or almost contiguous to the edge; oil-dots more or less concealed; *flowers in usually short panicles*, 3 *or* 2 *together or some solitary*, rarely 4 or more; stalklets shorter than the calyces, somewhat angular; tube of the calyx almost semiovate or slightly bellshaped; *lid double, the outer hemispherical and pointed, the inner depressed-semiglobular, transparent*, shining, almost or quite blunt, both slightly or somewhat shorter than the tube; stamens all fertile, inflexed before expansion; *anthers oval-clubshaped*, bursting by parallel slits; stigma not broader than the style; *fruits globular- or oval-urnshaped;* rim narrow, valves 3, rarely 2 or 4, deeply enclosed, very short and quite retracted; fertile much larger than the sterile seeds, all without appendage.

From the vicinity of Port Jackson (Newcastle, Leichhardt) known northward to Balmy Creek (Sir Thomas Mitchell), the Burnett-River (F. v. M.), Springsure and Gainsford (Dr. Wuth); at Dunjog in the Devonian formation (Wilkinson), generally on rising ground or tops and sides of hills.

A handsome tree. Stem straight, with a length up to 90 feet till branched, and a diameter of 3 feet. Bark smooth, somewhat shining, whitish or sometimes reddish-grey, mottled by bluish-white or brown-reddish spots indicating the places or rudiments of patches of older bark; hence the vernacular name. Leaves more or less shining, sometimes but slightly so. Two umbels occasionally arising from one point, appearing like one with 6 or 7 flowers, unless indeed they should be regarded as such. Stalklets exceptionally equalling the calyx in length. Unopened calyx often somewhat pearshaped. Outer operculum corresponding to the ordinary lid of congeners; inner lid forming a seceding integument to the cavity of the outer operculum. Connective of the anthers broader than the very narrow valvular portion. Fruits varying from $\frac{1}{3}$ to $\frac{2}{3}$ of an inch in length, slightly rough or even when dry faintly wrinkled, at all events not very smooth. Fertile seeds black and somewhat shining, about $\frac{1}{8}$ of an inch long, almost dimidiate-ovate, the often acute edge turned inward. The seedlings are rough from short red-brownish hair; their leaves scattered, stalked, oval- or oblong-lanceolar, inserted to the stalk above their roundish undivided base, reminding thus of the seedlings of the West-Australian Eucalyptus calophylla.

The wood, as stated by the Rev. Dr. Woolls, is used in ship-building, for wheelwrights' and coopers' work, but seems to vary in its qualities according to differences of localities, on which the trees arose.

E. citriodora can only be considered a variety of E. maculata, differing merely in the exquisite lemon-scent of its leaves, and holding as a variety precisely the same position to E. maculata, as Boronia citriodora to B. pinnata or Thymus citriodorus to T. Serpyllum. Mr. Bailey, who had opportunities to compare the two trees promiscuously growing, confirms their specific identity; he moreover discovered at Trinity-Bay a variety of E. crebra or of an allied

species also lemon-scented, the perfume and flavor of the leaves being so excellent as to serve for table-condiment. The citron-fragrance however is hereditary, and seems only developed within the subtropical regions of the range of the species. The leaves of E. citriodora are frequently finer veined. Mr. F. Kilner found the tree flowering in the month of July, when hardly any other kind of Eucalyptus was in bloom at Rockhampton. He mentions, that there the hardwood of E. citriodora is used for studs, which after twenty years show no decay; it is furthermore liked for fences, as it splits well, also for shafts of drays, as it is more pliable than most other Eucalyptus-timber, bending readily, and it is also used as material for wheels. Dr. Wuth sent leaves from an adventitious shoot 3 inches broad, and observes, that shoots will spring from stumps or after the destruction of the stem by fire from the root, such shoots representing E. melissiodora. I found the tree of moderate celerity of growth; and clearly it is highly eligible in its lemon-scented variety for arboreta and the distillation of perfumery. Its essential oil was provided already for the Exhibition of 1867.

In its systematic affinity E. maculata approaches nearest to E. eximia (Schauer, in Walpers repertorium botanices systematicæ ii. 925) and E. Watsoniana (F. v. M., fragm. phytogr. Austral. xi. 98); the former differs in the complete persistence of its bark, rendering it thick, rough and wrinkled, in the more subtle venation of its leaves, in flowers sessile on the ultimate usually also longer stalks, not unfrequently more than 3 (4–6) together and in considerably longer more ellipsoid fruits. E. Watsoniana is distinguished also by persistent bark, finer veins of the leaves, further by larger flowers, lid simple and in width exceeding the tube of the calyx, still more numerous and also longer stamens, fruits of much larger size with not suddenly descending and sharp but broad slightly decurrent rim and a very distinct outer annular channelled margin.

The Kino of E. maculata according to Dr. Julius Wiesner (Zeitschrift des oesterreichischen Apotheker-Vereines 1871, p. 500) dissolves easily in hot water, furnishing a slightly acid solution of winy odor and yellowish color and getting turbid when cold.

General Sir E. W. Ward, R.E., K.C.M.G., found the specific gravity of the wood to be at an average in four experiments 0·942, and he records also the strength of this timber to bear a transverse strain and its degree of elasticity, in which respect it ranks high in value, thought not equalling the best Ironbark-trees. Sir E. W. Ward's elaborate tables will be reproduced in these pages at a subsequent occasion.

Explanation of Analytic Details.—1, calyx with unexpanded stamens, the inner and outer lids lifted; 2, longitudinal section of unexpanded flower; 3, some stamens in situ; 4 and 5, back- and front-view of a stamen; 6, style and stigma; 7 and 8, longitudinal and transverse section of a fruit; 9 and 10, fertile and sterile seeds; 11, portion of a leaf; all magnified, but to various extent.

R.Austen del. et lith.

F. v. M. direxit

Steam Litho. Gov. Printing Office. Melb.

Eucalyptus obliqua. *l'Heritier.*

L'Héritier, sertum Anglicum 18, t. 20 (1788); Aiton, hortus Kewensis ii. 157 (1789); Smith, Botany of New Holland 43; Transactions of the Linnean Society iii. 287; Lamarck, tableau encyclopédique et methodique des trois règnes de la nature, Botanique t. 422; Salisbury, Paradisus Londinensis, t. 15; W. T. Aiton, hortus Kewensis, second edition iii. 193; F. M., fragmenta phytographiæ Australiæ ii. 45 et 172; Bentham, flora Australiensis iii. 204; E. gigantea, J. Hooker, in London Journal of Botany vi. 479; flora Tasmanica i. 136, t. xxviii.; E. fabrorum, Schlechtendal, Linnæa xx. 656; E. nervosa et partim E. falcifolia, Miquel, in Nederlandisk Kruidkundig Archief iv. 136 et 139.

Finally very tall; leaves scattered, sickleshaped- or sometimes oval-lanceolar, equally green and shining on both sides; their *lateral veins not very spreading*, rather prominent, the circumferential vein somewhat removed from the edge; oil-dots concealed; umbels with 4 to several or less frequently 3 or many flowers, lateral and axillary; stalk rather slender, slightly compressed; *calyces somewhat glandular-rough, not angular; lid hemispherical*, depressed or scarcely pointed; tube conspicuously longer than the lid, obconical, gradually attenuated into an usually short stalklet; stamens comparatively short, all fertile, inflexed before expansion; *anthers kidneyshaped; fruit truncate-ovate, somewhat contracted at the orifice, rim outwards narrow; valves enclosed*, oftener 4 than 3, rarely 5, short; sterile seeds mostly not much narrower than the fertile seeds, all without appendage.

On mountain-ranges as well of the silurian as granitic formation, also occasionally on sandy heathy ridges, from St. Vincent's Gulf to Gippsland, scarcely passing into the territory of New South Wales, constituting vast forests, frequent also in Tasmania, ascending to high but not to alpine elevations.

The "Stringybark-tree" of South Australia and Tasmania, but in Victoria more generally called the "Messmate-tree," on account of its resemblance to E. macrorrhyncha, which in our colony passes mostly as Stringybark-tree.

A straight-stemmed tree of rapid growth, attaining a maximum-height of about 300 feet and almost always lofty, though occasionally flowering already in an almost shrubby state. Bark persistent on stem and branches, very fibrous, easily igniting, not tough but rather soft and fragile, outside somewhat greyish, not so deeply furrowed as that of E. macrorrhyncha. Stem proportionately tall. Leaves of young saplings broad, verging somewhat into a cordate form. Ordinary leaves rather stiff, very unequal-sided towards the base, hence the specific name, which however applies to the majority of congeners; veins diverging at a very acute angle. Umbels containing sometimes as many as 20 flowers. Flowerbuds together with their stalklets clubshaped. Stigma not dilated beyond the width of the style.

E. obliqua was the species, first of all rendered known, and on which l'Héritier founded the genus, so named in allusion to the flowers, well covered by a cap or lid, although Dr. Wm. Anderson, the surgeon of Capt. Cook's second and third expeditions, had bestowed not inaptly the name of Aromadendrum on the genus already, when visiting with Capt. Furneaux the bay, on which Hobarton has since arisen. In the Catalogue of the Banksian Library ii. 32 and iii. 184 (according to Robert Brown) the appellation given by Surgeon Anderson was early recorded. As surmised by me (in the fragmenta ii. 45) it is this very species, which was collected during Furneaux's voyage at Adventure-Bay, and this was proved subsequently by Mr. Rich. Kippist, who at my request compared the original specimen in the Banksian collection. I had no access in 1860 to the second edition of the Hortus Kewensis, where already in 1811 Tasmania was mentioned as the native land of E. obliqua, the erroneous statement in the Transactions of the Linnean

Society, that it was from the "warmer parts of New Holland" having misled long afterwards, and hindered the recognition of this species till recent times.

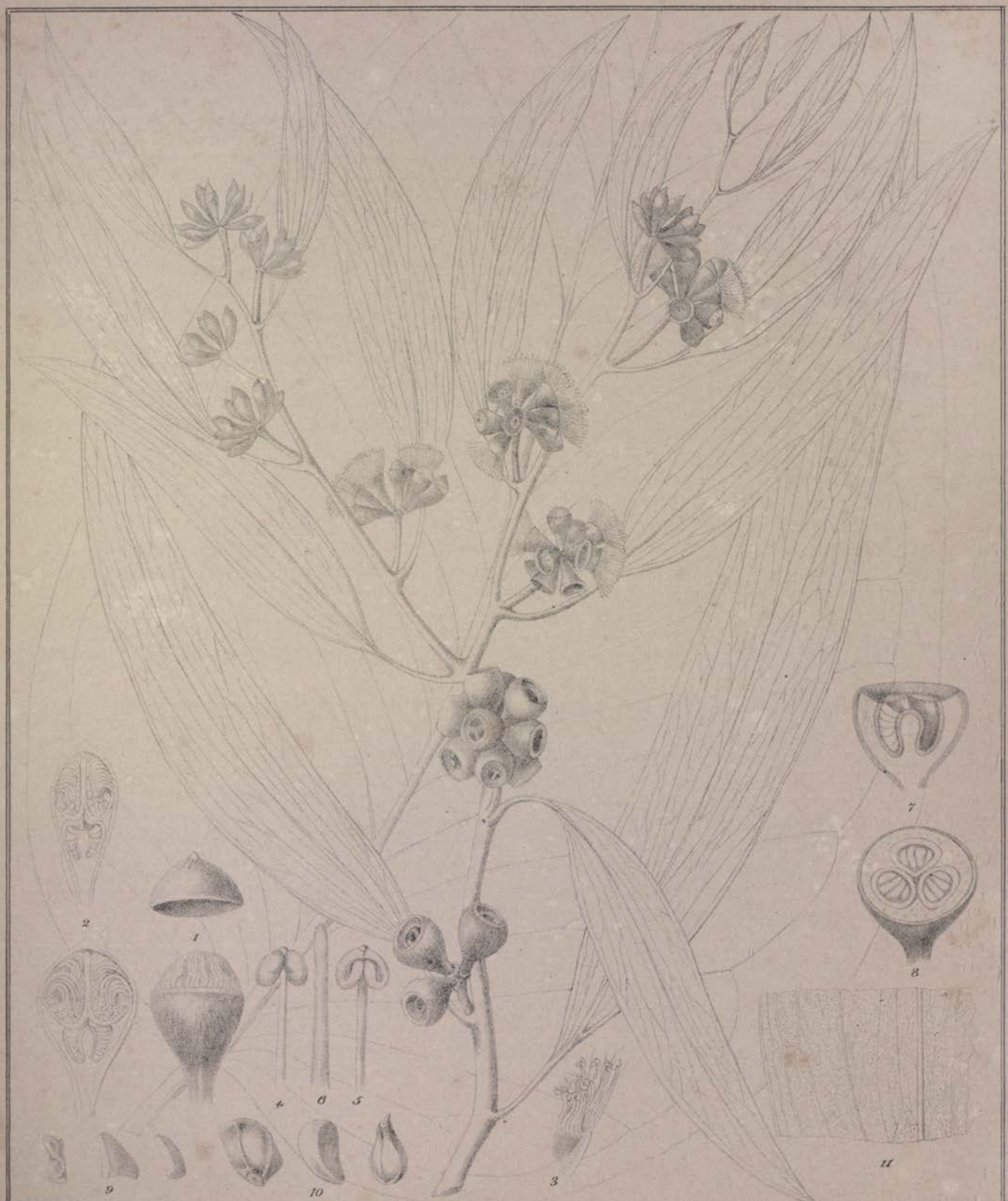
E. cneorifolia, as drawn by Heyland for De Candolle's mémoire sur la famille des Myrtacées pl. 9, differs from E. obliqua only in shrubby habit, very narrow leaves with thinner veins and fruit-valves sometimes less enclosed; it is evidently dwarfed by cold in the high elevations of its growth at about 4,000 feet in the Blue Mountains. But in De Candolle's prodromus iii. 220 and in Bentham's flora Australiensis iii. 217 this high-land species is confused with one of low arid country in Kangaroo-Island, which belongs to E. oleosa. What precise relation E. stricta (Sieber, in Sprengel curæ posteriores 195) and E. obtusiflora bear to E. cneorifolia, which as here defined belongs certainly to the Renantheræ, remains to be ascertained.

E. obliqua can be distinguished readily enough from E. piperita by its thicker and usually larger leaves with more prominent and less divergent veins, the under-page of the leaves neither evidently paler nor less shining than the upper side (hence the stomata are in almost equal number on either side of the leaves), in less crowded umbels, in calyces less smooth, with shorter and blunter lid, the greater elongation of the calyx-tube into the stalklet and also the rather larger fruit with comparatively less constricted orifice. The two are the only species among closely allied kinds, which have the summit of the fruit very considerably contracted, hence no difficulty can arise for recognizing E. obliqua. The veins of the leaves are occasionally so much longitudinal as to bring E. obliqua thus far into close approach to E. pauciflora, which species is allied also in many other respects, but has a smooth whitish bark, the outer stamens not all fertile, the fruit hardly contracted at the summit, the rim not so narrow and the valves nearer to the orifice; the wood of the two is also different. The calyx however is likewise somewhat rough in E. pauciflora.—E. Sieberiana in comparison to E. obliqua can be easily recognized by its more rugged and solid bark, which partially secedes, by its less fissile wood, the less prominent veins of its leaves, generally broader and more compressed flowerstalks, outer stamens sterile, fruit less contracted at the orifice with flatter rim and with valves near the summit.

E. obliqua is one of the most important of all our trees in regard of its vast abundance (being the most gregarious of any of our forest-trees) and on account of the ease with which the wood is worked. It supplies a large portion of the ordinary sawn hardwood-timber for rough building purposes; being very fissile it is also extensively split into fence-rails, palings and shingles; it is however subject to early decay when used underground. It is light colored. The specific gravity of the wood varies from 0·809 to 0·990, or from 50 to 60½ lbs. per cubic foot. Mr. F. Campbell found the tensile strength per square inch equal to a pressure of 8,200 to 8,500 lbs.

The bark of E. obliqua is extensively used for roofing primitive rural buildings; it is also suitable, as first shown by the writer, for the manufacture of paper, not only for packing but also for printing and even writing, further for mill- and paste-boards. The pulp bleaches rapidly. The bark contains only from 2·50 to 4·19 per cent. of Kino-tannin, in which respect it contrasts unfavorably with that of E. macrorrhyncha, which provides from 11·12 to 13·41 Kino-tannic acid. The best Kino of E. obliqua dissolves completely in boiling water, yielding a neutral deep-reddish solution, which remains clear and is free of Gum, as long ago shown by Dr. Wiesner.

EXPLANATION OF ANALYTIC DETAILS.—1, upper portion of unexpanded flower, the lid lifted; 2, longitudinal section of an unexpanded flower; 3 and 4, front- and back-view of an anther with filament; 5, style and stigma; 6 and 7, transverse and longitudinal section of a fruit; 8 and 9, sterile and fertile seeds; 10, embryo; 11, the same partly uncoiled; 12, portion of a leaf; all figures more or less magnified.



Todt. del. C Troedel & Co Lith. F.v.M. direxit. Sienm. Litho. Gov. Printing Office Adelt.

Eucalyptus pauciflora. *Sieber.*

Sieber, in Sprengel curæ posteriores 195 (1827); E. coriacea, Cunningham, in Walpers repertorium botanices systematicæ ii. 925 (1843); J. Hooker, flora Tasmanica i. 136; F. M., fragmenta phytographiæ Australiæ ii. 52; Bentham, flora Australiensis iii. 201; E. piperita, varietas pauciflora, De Candolle, prodromus systematis naturalis regni vegetabilis iii. 119; E. phlebophylla, F. v. M. et Miquel, in Nederlandisk Kruitkundig Archiev iv. 140; E. submultiplinervis, Miquel, as quoted, 138.

Finally tall; *leaves* scattered, elongated-lanceolar, sometimes verging into a lanceolar-oval form, but slightly curved or somewhat sickleshaped, of equal color and shining on both sides, of thick consistence; *veins almost longitudinal, several arising nearly together from the acute base of the leaf*, the intramarginal vein slightly removed from the edge and all main-veins often prominent; umbels axillary, solitary or sometimes forming a short racemous panicle, varying with from few to many flowers in each, on almost cylindrical or somewhat angular but never dilated-compressed and seldom much elongated flowerstalks; flowers rather small, on very short stalklets; tube of the calyx semiovate-obconical, not strongly angular; *lid hemispheric, twice or thrice shorter than the tube*, quite blunt or occasionally somewhat acute or much depressed; stamens generally all fertile, inflexed before expansion; *anthers almost kidneyshaped*, opening by very divergent slits; stigma not broader than the summit of the style; fruits semi-ovate or truncate-ovate, slightly or hardly contracted at the summit, 3- more rarely 4- to 5-celled, their rim more or less flat; valves very short, convergent from near the summit of the orifice, not or but slightly exserted, almost deltoid; seeds without any appendage, the sterile mostly not much narrower than the fertile seeds.

From the lowest hills to the highest mountains, as well in the granite- as in slate-formations, from the Glenelg-River (F. v. M.) dispersed through the southern districts of the colony of Victoria and the coast-countries of New South Wales, there known westward to Mittagong (Moore) and Braidwood (Wilkinson), extending to New England (Leichhardt), reaching in a dwarfed state to nearly the snow-line in the Australian Alps, frequent through the ridgy lowlands and also the uplands of Tasmania.

A medium-sized tree, but occasionally fully 100 feet high, of stately and even handsome appearance, the stem reaching a diameter of 4 feet; the main branches often very spreading; the branchlets slender and more or less pendulous. The bark is smooth, not very thick and outside whitish-grey as in other trees of the section Leiophloiæ, and hence it is also one of the White Gum-trees of the colonists. The branchlets and inflorescence, particularly in the alpine variety, are sometimes covered with a bluish-white bloom. The oil-dots are copiously visible only in the young and then still membranous leaves, but become concealed or obliterated, when the foliage attains its almost leathery thickness; the veins are not rarely, particularly in colder regions, tinged conspicuously red, in which coloration the branchlets also often participate. Leaves occur occasionally on young trees or on adventitious shoots lengthened to nearly one foot and widened to a breadth of over half a foot, thus presenting almost an oval form, as shown in the background of the lithogram. In the alpine variety the leaves are often shorter and proportionately broader and the fruits smaller. A pair of lanceolar bracts enclose the umbel in its earliest stage. Sir Joseph Hooker counted up to forty flowers in an umbel; I found sometimes as few as three only. Opossums have a predilection for the young foliage, so much so, that in localities, where these creatures are long out of reach of the aboriginal or colonial hunters, E. pauciflora often dies through being deprived of its respiratory organs for the continuance of the functions of its life. Even cattle and sheep browse in seasons of drought on the foliage (Woolls).

Mr. G. W. Robinson observes, that the timber is comparatively soft, thus easy to cut, and of a lighter color than that of most Eucalypts, also that it splits fairly, but cannot readily be obtained in great lengths ; it is rather brittle, short in grain and cannot be used underground, but is excellent for fuel ; it is in use also for log-fences.

The principal interest of this species concentrates in its quality to cope with rather severe frosts ; indeed together with E. Gunnii it constitutes miniature-forests up to 5,500 feet in our Alps, growing close to glaciers, which on the shade-sides of glens do not wholly melt in our latitudes, whenever situated over 6,000 feet high, though in the cooler latitudes of Tasmania the limit of eternal snow descends about 1,000 feet lower, it being understood only in the wide crevices or chasms of rocks or in other places, where the sun cannot exercise any direct effect. Thus the bare crests of our Alps may be free of snow in the height of summer even at nearly 7,000 feet, and we have therefore nowhere in Australia an absolute permanent snow-line in the strict sense of the word.

In nature E. pauciflora is easily recognized by the smooth whiteness of its stem to near the ground, combined with the characteristic of its almost parallel-veined leaves and the size and shape of its flowers. Among the Renantheræ only E. stellulata exhibits the peculiar venation of the leaves of E. pauciflora, several of the veins arising together from the base ; it is however a much smaller tree, which does not ascend fully so high into alpine regions, and which moreover is readily recognized by its mostly shorter leaves, the smallness of its flowers, slender calyces with conical lids and smaller fruits ; moreover its bark is semipersistent. Some resemblance to E. Sieberiana is also obvious, but that species belongs really to the Heterostemones (or Hemiantheræ), shows no perfect decortication of the upper layers of the bark, has the stomata not absolutely isogenous, the leaf-veins evidently more spreading and less prominent and not several basal veins confluent. In their fruits however E. pauciflora and E. Sieberiana are much alike.

Although the name of E. coriacea, bestowed on this species by Allan Cunningham, was perhaps given soon after his arrival in New South Wales (1816), yet Sieber, who gathered this species in 1823, must also have named it then already or soon subsequently, for it appeared on his authority in Sprengel's curæ posteriores already as E. pauciflora in 1827, therefore sixteen years before the name given by Cunningham became established ; thus Sieber's appellation clearly takes precedence under the rules of priority. Though the designation of E. pauciflora does not apply so well to the generality of the forms of this species as the name of E. coriacea, yet in comparison to paniculate species it is applicable enough. E. procera (Dehnhardt, Rivista Napolitana, i. 174), according to the published diagnosis in Walpers repertorium botanices systematicæ ii. 164, can only be referred to E. pauciflora.

Explanation of Analytic Details.—1, longitudinal section of an unexpanded flower; 2 and 3, front- and back-view of an anther with part of the filament ; 4, stamens in situ ; 5, pistil ; 6 and 7, longitudinal and transverse section of fruit ; 8 and 9, sterile and fertile seeds ; 10, portion of a leaf ; all magnified, but to a various extent.

R.Austen del. et Lh.

F. v. M. direxit.

Steam Litho. Gov. Printing Office Melb.

Eucalyptus. pilularis. *Smith*

Smith, in the Transactions of the Linnean Society iii. 284 (1797), according to Bentham, flora Australiensis iii. 208; Kippist, in F. M. fragmenta phytographiæ Australiæ ii. 172; E. persicifolia, Candolle, prodromus systematis naturalis regni vegetabilis iii. 217, partim; E. semicorticata, F. M., in the Journal of the Proceedings of the Linnean Society iii. 86.

The "Blackbutt-tree."

Finally tall; branchlets conspicuously angular; leaves scattered, narrow- or sickleshaped-lanceolar, rather more shining above than below; their *lateral veins very subtle and numerous*, moderately spreading, the circumferential vein somewhat removed from the margin of the leaf; oil-dots concealed; umbels mostly axillary and solitary or a few terminal and aggregated, bearing from 4 to 16 flowers; *stalk strongly compressed;* stalklets rather thick, angular, nearly as long as the calyx or variously shorter; *lid below hemispherical or broadly conical, attenuated into an acute summit,* slightly longer or almost shorter than the semiovate tube of the calyx, the latter not angular; stamens all fertile, inflexed before expansion; *anthers kidneyshaped,* opening by divergent slits; stigma not dilated; *fruit semiovate* or almost truncate-ovate, 3- or oftener 4- rarely 5-celled; *valves deltoid, inserted slightly below the broadish somewhat flat or inward descending rim;* sterile seeds mostly not much narrower than the fertile seeds, all without appendage.

In wooded country from Eastern Gippsland to Southern Queensland, advancing into mountain-regions, but confined to the littoral slopes.

A tree, attaining under favorable circumstances a height of 300 feet and a stem-circumference of 45 feet (Camara, Kirton), but as a rule of much less dimension. Rough bark covering the lower part of the stem and sometimes persisting even to the branches, blackish-grey outside, somewhat fibrous and brownish inside, traversed according to Dr. Beckler by cross-fibres; bark of the branches and also sometimes of the upper portion of the stem smooth, grey or whitish. Timber excellent for general purposes, used largely for building, furnishing material for flooring-boards and superior shingles, also utilized for telegraph-poles and railway-sleepers (Woolls, Kirton).

The systematic name for this species is not happily chosen, and seems to have been intended originally by Sir James Smith for that species, which Mr. Kippist and Mr. Bentham from inspection of Smith's collections consider to be E. piperita; but the fruit-bunches depicted under that name by Surgeon-General John White in his "Journal of a Voyage to New South Wales" belong, I should think, to the species now adopted as E. pilularis, although the fruits of the latter never approach to a pilular form like those of the modern E. piperita; Smith therefore quotes in the Transactions of the Linnean Society from White's figure cautiously the leaves only for E. piperita; to the confusion about the last mentioned species is added from the commencement by Dr. White, attributing at page 226 to his E. piperita a bark. "very smooth like that of a poplar." The compressed flowerstalks, mentioned particularly in the description of E. piperita (in the Linnean Transactions iii. p. 286, and for which further should be referred to Smith's Botany of New Holland, p. 42) would also indicate E. pilularis as now perhaps wrongly defined, whereas the globular fruit of E. pilularis, as aptly described in the Linnean Transactions of 1797, would apply not to that species as now understood, but to the E. piperita of the present day. I was tempted to transpose the names of the two species, though sanctioned by high authority (as Du Roi did under similar circumstances with Pinus picea and P. Abies), so that the species with the pillshaped fruits might at once be remembered by its adjective name; but I have left the nomenclature for the present as it is, more especially as the now acknowledged E. pilularis is not

a species particularly rich in volatile oil, so that White in all likelihood had the oil, to which he refers, distilled from another species and probably one with smooth bark.

Dr. Leichhardt records the native name of E. pilularis as "Benaroon."

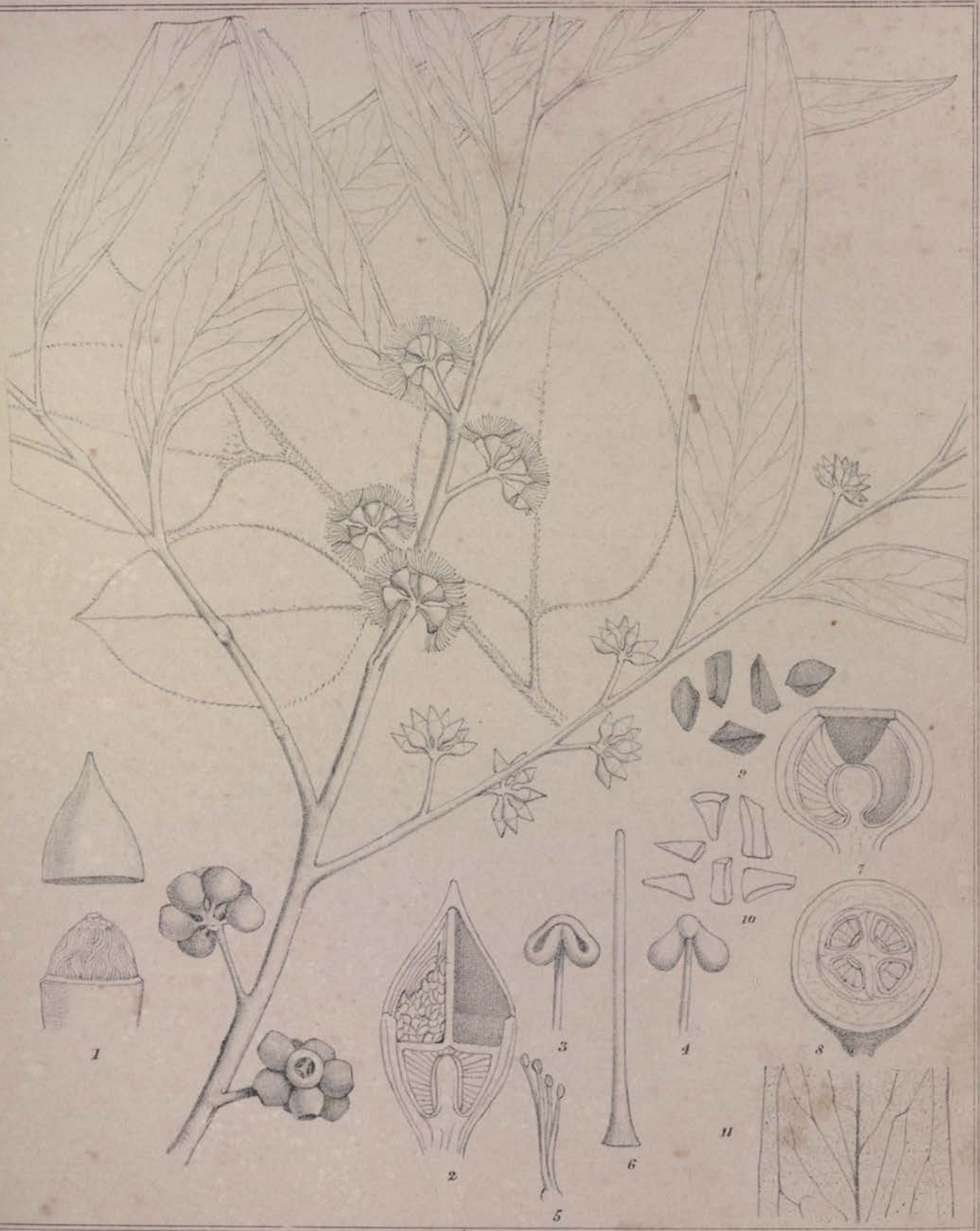
The nearest ally to this tree is E. acmenoides (Schauer, in Walpers repertorium botanices systematicæ ii. 924), of which I compared an original specimen gathered in January 1817 by Allan Cunningham near Port Jackson and communicated by the late Mr. Heward; either as a variety or as a species it differs from E. pilularis, as here assumed, in more fibrous outside paler and still more extensively persistent bark (being placed by the Rev. Dr. Woolls among the Rhytiphloiæ, not as E. pilularis among the Hemiphloiæ), further in leaves of smaller size, thinner consistence and beneath paler hue with only hypogenous stomata and more visible oil-dots, in smaller flowers on thinner stalklets and less compressed stalks, smaller fruits with a narrower rim and often rather more enclosed valves. The small bunch of fruit, shown separately on the lithogram of E. pilularis, belongs to E. acmenoides; and if this really should indicate a mere variety, the specific appellation pilularis would become more justifiable. It is possible, that a histologic examination of the bark in the native places of E. acmenoides would reveal further differences. Dr. Woolls, Mr. Fawcett and Mr. Wilkinson call it White Mahogany, whereas Mr. Th. Wentworth Watson, Mr. Bailey and others designate it as a Stringybark-tree. The name employed for it by the natives of the Richmond-River is "Jundera." It ranges over a wider geographic area than the typical E. pilularis, extending far into the tropical regions of Eastern Australia. The wood is fissile, thus splits well into slabs and palings; it is regarded of superior quality. Mr. Wilkinson saw the stems attain in the Devonian formation a diameter of 4 feet.

The young seedlings of E. pilularis are smooth, their leaves oblong- or narrow-lanceolar, sessile, grey beneath, perceptibly dotted with pellucid oil-glands. The illustration now offered does not represent sufficiently a tendency to a partially terminal inflorescence nor the flatness of the flowerstalks.

E. siderophloia is easily distinguished from E. pilularis by its entirely persistent and deeply furrowed bark, the texture of its wood, often broader leaves, always paniculated flowers of less number in the umbels, not distinctly compressed flowerstalks, the calyx-tube more gradually attenuated into the stalklet, roundish anthers with parallel slits, dilated stigma, almost pearshaped-obconical fruits with emersed rim and exserted valves, the latter not forming a flat but very convex summit.

General Sir E. Ward found the deflection of the fresh timber to be 1·35 inch, the material used being 4 feet long by 2 inches square, loaded in the middle, bearing weight to 980 lbs. while the elasticity remained unimpaired and breaking under a weight of 1,232 lbs. Specific gravity about 0·897.

Explanation of Analytic Details.—1, portion of unexpanded flower, the lid lifted; 2, longitudinal section of an unexpanded flower; 3 and 4, front- and back-view of an anther with part of filament; 5, stamens in situ, their anthers presented at a side-view; 6, style and stigma; 7, longitudinal section of an abnormal fruit, the valves sunk exceptionally deep; 8, longitudinal section of an ordinary fruit; 9, transverse section of fruit; 10 and 11, fertile and sterile seeds; 12, portion of a leaf; all magnified, but to various extent.



R.Austen del et Lith. F. v. M. direxit. Steam Litho. Gov. Printing Office Melb.

Eucalyptus piperita. *Smith*

Smith, in White's Journal of a Voyage to New South Wales 226, partly (1790); Botany of New Holland 42; Transactions of the Linnean Society iii. 286; Kippist, in F. M. fragmenta phytographiæ Australiæ ii. 173; Bentham, flora Australiensis iii. 207; E. acervula, Sieber, in De Candolle prodromus systematis naturalis regni vegetabilis iii. 217; F. M., fragmenta phytographiæ Australiæ ii. 64.

Finally tall; branchlets slender; leaves scattered, sickleshaped-lanceolar, not very long, rather more shining above than below; their lateral *veins very subtle* and numerous, usually more erect than transverse, the circumferential vein somewhat removed from the margin of the leaf; oil-dots copious, more or less pellucid; umbels axillary or mostly lateral, bearing from 5 to 15, rarely 3 to 4 flowers; *stalk slender*, slightly compressed; stalklets considerably shorter than the calyx; *lid broad-conical, acute*, about as long as the semiovate tube of the calyx, the latter not angular; stamens all fertile, inflexed before expansion; *anthers kidneyshaped*, opening by divergent slits; style capillary; stigma not dilated; *fruits* usually small, *truncate- or globular-ovate, contracted at the narrow-edged orifice; valves perfectly enclosed*, 3 or much oftener 4, deltoid; sterile seeds mostly not much narrower than the fertile seeds, all without appendage.

On less fertile ground, from the coast to mountain-regions, occurring even on sand-lands, in Gippsland and New South Wales.

The White Stringybark of the colonists, called by the Gippsland natives, with E. macrorrhyncha and E. capitellata, "Yangoora."

Trunk to as much as 4 feet in diameter. Stem and branches covered with fibrous outside grey and rough bark. Seedlings smooth, with oval- or oblong-lanceolar or broad-oval leaves, the lower of these opposite, the upper ones scattered. Leaves of the advanced tree dark-green, usually of rather thin consistence. Umbels often crowded, never terminating the branchlets, now and then paniculated, but in such a case still lateral. Fruits occasionally larger and less roundish than illustrated in the lithogram, with their edge sharp, which is not well shown in the lithographic drawing.

E. piperita differs from E. pilularis chiefly in its rough bark extending to the branches (Pachyphloiæ), more slender and less angular branchlets, more distinctly developed oil-glands of the foliage, not so much compressed flowerstalks, smaller flowers with hardly any tendency to aggregation into terminal panicles, fruits mostly smaller and at the orifice contracted with an acute rim and evidently sunk valves.

E. eugenioides (Sieber, in Sprengel curæ posteriores 195), which extends from near Port Phillip to South-Queensland and ascends the higher Alps in a dwarfed state, shares in some of the characteristics of E. piperita and in others of E. pilularis; but its seedlings are hairy-rough, and the edge of the fruit is blunt, with the valves situated near it, reminding more of the fruits of E. hæmastoma. The scabrous seedlings depicted in the background of the lithogram of E. piperita belongs to E. eugenioides, which is considered by Bentham a variety of that species.

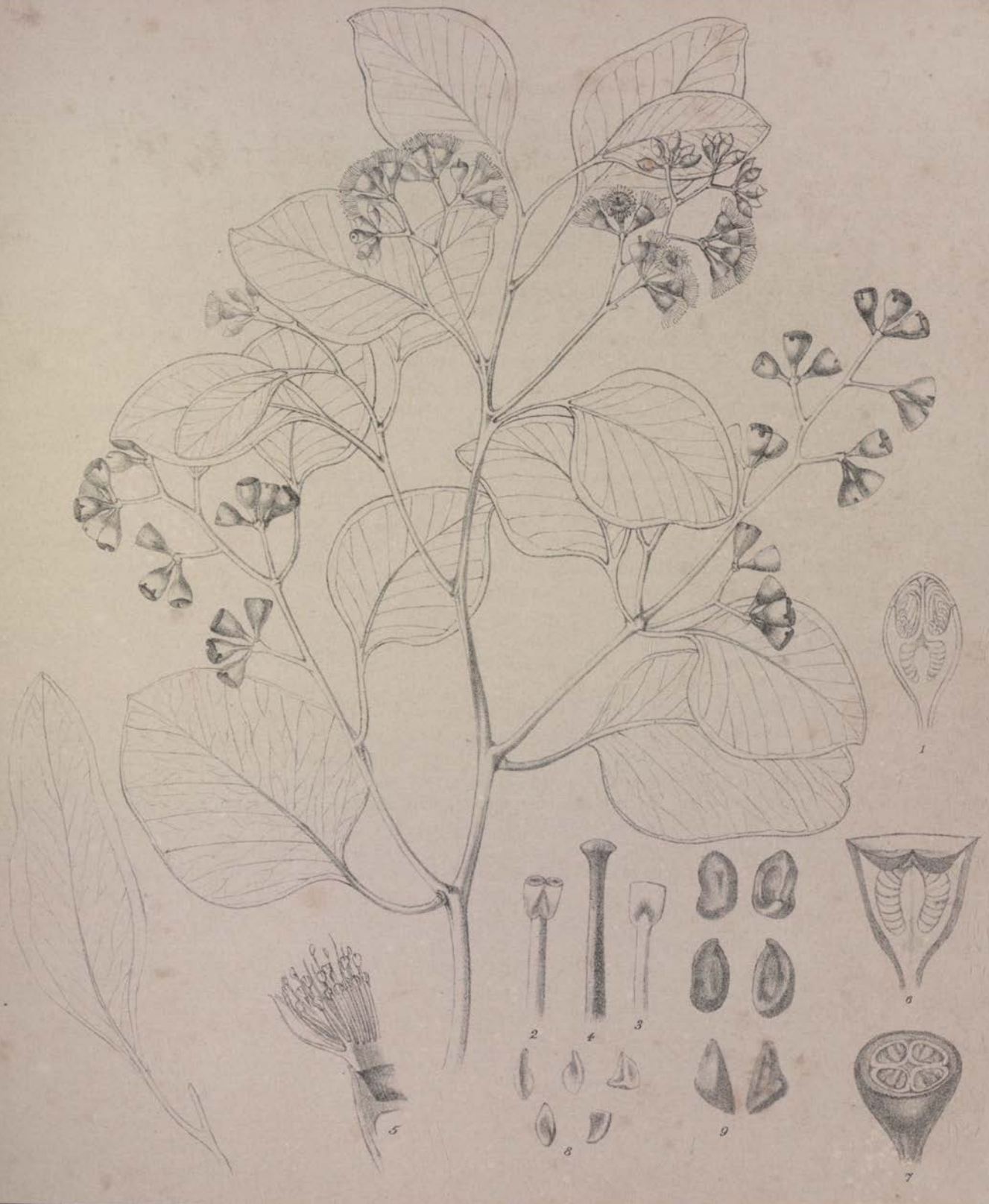
E. obliqua is distinguishable from E. piperita by its larger and thicker leaves of equal shining color on both sides, with more prominent and less divergent veins and with stomata rather more equal in number on either page, by its umbels never so much crowded, by the shorter and rounded-blunt lid, the longer and conically attenuated tube of the calyx, the somewhat longer fruits and perhaps by anatomic, histologic and chemical peculiarities of the bark and wood, which characteristics remain yet more comprehensively to be studied.

EUCALYPTUS PIPERITA.

The Eucalyptus-oil, so largely exported particularly by Mr. Joseph Bosisto since many years, is not derived from this species, but from E. amygdalina. The vernacular name "Peppermint-tree" arose from this Eucalyptus, being bestowed on it already in the first year of the colonisation of New South Wales by Dr. White, because the scent of the foliage resembling that of the Peppermint-Herb; but this colonial appellation has become since extended to many other congeners in various parts of Australia. This fancied resemblance of Eucalyptus-oil to that of Peppermint is explanatory also of the specific name adopted for this particular tree in science. Though timber of very large dimension is obtainable from E. piperita, yet according to the Rev. Dr. Woolls the wood is inferior to that of some other kinds of Stringybark-trees.

As stated under E. pilularis the fruit, depicted by White as that of his E. piperita, belongs to the former not the latter, as now understood, although it is not pilular.

Explanation of Analytic Details.—1, upper portion of an unexpanded flower, the lid lifted; 2, longitudinal section of an unexpanded flower; 3 and 4, front- and back-view of an anther with portion of the filament; 5, some stamens in situ, the anthers seen from the side; 6, style and stigma; 7 and 8, longitudinal and transverse section of fruit; 9 and 10, fertile and sterile seeds; 11, portion of a leaf; all magnified, but in various degrees.



Todt del. C.Troedel & Cº Lith. F v M. direxit. Steam Litho Gov Printing Office, Melb

Eucalyptus polyanthema. *Schauer.*

E. polyanthemos, Schauer, in Walpers repertorium botanices systematicæ ii. 924 (1843); Bentham, flora Australiensis iii. 214; Woolls, contribution to the flora of Australia 236.

The "Den-tree."

Branchlets very slender; *leaves* scattered, on rather long stalks, *orbicular- or broad-ovate or roundish, of an almost ashy-hue or dull-greenish*, occasionally verging into an oval-lanceolar form; primary veins considerably spreading, the circumferential veins distinctly removed from the edge; *umbels paniculate* and mostly terminal; flowers in each umbel very few, usually of rather small size and on very short stalklets; tube of the calyx truncate-ovate, doubly or thrice longer and also broader than the depressed- or pyramidal-hemispherical faintly pointed lid; stamens much inflexed while unexpanded; *outer stamens sterile; fertile anthers truncated, opening by terminal pores;* stigma somewhat dilated; fruits rather small, semiovate, with a narrow compressed fragile occasionally somewhat indented margin, 3- or 4-celled or rarely 5-celled; valves enclosed, very short; seeds without any appendage.

On dry ridges and hills or undulatory country from the vicinity of Port Phillip north-westward to the Pyrenees, eastward to the Gippsland-Lakes and the Genoa (F. v. M.); northward to the tributaries of the Darling-River, advancing thence to the coast-districts of New South Wales, thus occurring also near Port Jackson (at Liverpool, Woolls).

A middle-sized tree; exceptionally about 250 feet high (in the Ovens-Ranges, Falck), called "Den" by the Gippsland-natives (Howitt), but Red Box-tree by our colonists, on account of the reddish tinge of its wood, occasionally also passing among the woodmen as Grey or Bastard-Box-tree. Bark persistent as well on the branches as on the stem (unless the upper ramifications or rarely also the lower are smooth from outer decortication), slightly furrowed, grey outside. Wood close-grained and twisted, very tough and so hard, as to have given rise to the name of Lignum Vitæ for it in some regions of New South Wales (Woolls). Leaves sometimes acuminated, but generally those of the young saplings and of the aged tree not very different in shape. Veins not very crowded, nor as a rule very prominent. Oil-glands copiously visible in young leaves, becoming much concealed or evanescent at last. Inflorescence also not rarely participating in the grey bloom of the foliage. Lid double in early stage, the outer minute and fugacious.

The specific name is derived from the comparative copiousness of the flowers.

Great lastingness is attributed to the wood, though the stems become often hollow in age, and thus afford not readily timber of large dimensions. The wood is much sought for cogs, naves and felloes; it is also much in demand for props of shafts in mines; for fuel it is unsurpassed. According to Mr. J. Smith it is this species, which braved the severest winters at Kew-Garden near London, sheltered merely by a wall.

As regards its specific affinities E. polyanthema comes very near to E. melliodora, with which it agrees in the remarkable dehiscence of the anthers by terminal pores; but it recedes in the bark not being yellowish inside, but softer, more fibrous and outside rather more grey, in the reddish color of the wood, in the broader and more generally greyish leaves, in rather shorter stalklets of the flowers, smaller lids of the calyx, more paniculated flowers, less dilated stigma, fruits less distinctly contracted at the orifice, with a narrower less firm and less distinctly annular rim and generally lesser number of valves and cells. Both occur in some places promiscuously and seem to preserve under the same circumstances of soil and climate each their distinctive

characteristics; still on the whole E. polyanthema prefers more the top of rises, while E. melliodora descends rather to the richer soil of the valleys. Its distinctness from E. populifolia seems indisputable, as the foliage is not shining, the flowers are of larger size and on more conspicuous stalklets, many of the outer stamens devoid of anthers, the latter opening terminally, the filaments not being dark-colored and the fruits larger; the geographic range of both is also different.

E. Behriana shows usually lesser height, more rigid narrower and somewhat shining leaves, stouter panicles, lesser development of the stalklets of the flowers, all stamens fertile, anthers with lateral pores, often smaller fruits, always with firmer rim.

Bentham (flora Australiensis iii. 214) unites with this E. Baueriana (Schauer, in Walpers repertorium ii. 924), the diagnosis of which agrees sufficiently and proves it to be different from E. populifolia. Bauer most probably obtained his specimens from the vicinity of Sydney and not from the tropical regions of Australia.

E. oligantha (Schauer, in Walpers repertorium iii. 924) from Copeland-Island, of which species I have not yet seen authentic material, seems according to description very closely allied to E. polyanthema, differing chiefly in stiffer leaves, somewhat larger flowers, conical lid and perhaps the (as yet unknown) fruit.

EXPLANATION OF ANALYTIC DETAILS.—1, longitudinal section of an unexpanded flower; 2 and 3, front- and back-view of a stamen; 4, style and stigma; 5, a portion of the calyx with fertile and sterile stamens; 6 and 7, longitudinal section of a fruit; 8 and 9, sterile and fertile seeds; all more or less enlarged.

Todt. del. C. Troedel & Co Lith. F. v. M. direxit. Steam Litho. Gov. Printing Office Melb.

Eucalyptus populifolia. *Hooker.*

EUCALYPTUS POPULIFOLIA.

Hooker, icones plantarum 879 (1852).

Branchlets slender; *leaves* scattered, on rather long stalks, *orbicular-ovate or roundish, very shining* and intensely green on both sides, occasionally verging into an oval-lanceolar form; veins very spreading, but not crowded; the circumferential vein distinctly removed from the edge; the oil-dots copious and mostly transparent; *umbels paniculate* and mostly terminal or some singly axillary; flowers in each umbel from very few to 14, of very small size, on extremely short stalklets; tube of the calyx almost semiovate, slightly longer than the nearly hemispherical lid; stamens much inflexed while unexpanded, all fertile; *anthers roundish-ovate, opening below the summit by pores* or abbreviated slits; style very short; stigma somewhat dilated; *fruits very small*, semiovate, 4-celled or sometimes 3- or 5-celled; valves very short, situated close beneath the rim; seeds minute, without any appendage.

In open forest-country from the southern as well as northern tributaries of the Darling-River, advancing eastward to the coast-country and northward to the Upper Burdekin-River, southward to the Murrumbidgee.

A middle-sized or small tree, with wrinkled and somewhat fissurated bark, which persists as well on the branches as on the stem. The colonial designations of this tree are Shining or Poplar-Box-tree; the natives of eastern subtropical Australia call it "Bembil," according to Mr. Edward Bowman, who also remarks, that the wood proved durable for posts; but of the particular quality of the timber no records seem existent. Leaves occur sometimes 4 inches wide.

With Sir William Hooker I regarded this as a species, distinct from E. polyanthema, when defining it anew in 1858 (Journal of Proceedings of the Linnean Society iii. 93), after having watched it for months in 1856 through its natural range. It replaces in the warmer latitudes of the more interior regions of East-Australia the more southern E. polyanthema. In the journal above quoted I had changed the name of this species to E. populnea, as Desfontaines had mentioned (Catal. hort. Paris 1829, p. 408) already an Eucalyptus under precisely the same name, employed by Hooker. The differences set forth in the description as distinguishing E. populifolia from E. polyanthema, I believe to be specific; they consist in leaves of lustrous green, often less compound inflorescence, smaller and more crowded flowers on shorter or hardly any stalklets, proportionately larger lid, stamens all fertile, anthers with more lateral openings, filaments of darker color and smaller fruits.

E. hemiphloia could hardly ever be confounded with E. populifolia, although it belongs also to the section of Porantheræ, its leaves are less shining and never broad, the flowers conspicuously larger on longer and thicker stalklets, the lid gradually pointed, the fruits longer, the valves not approaching to the orifice, while as indicated by the specific name the bark is not persistent on the branches and often neither on the upper portion of the stem; this species does not extend to Spencer's Gulf, being known only from New South Wales and Southern Queensland and there confined to the coast-districts or near to them. The South Australian tree, mentioned under this name by Bentham, is E. Behriana, as proved by some differences in the leaves, the suppression of the stalklets and shortness of the lid as well as of the stamens. Again, the variety parviflora of E. bicolor, mentioned in the flora Australiensis iii. 215, belongs also to E. populifolia.

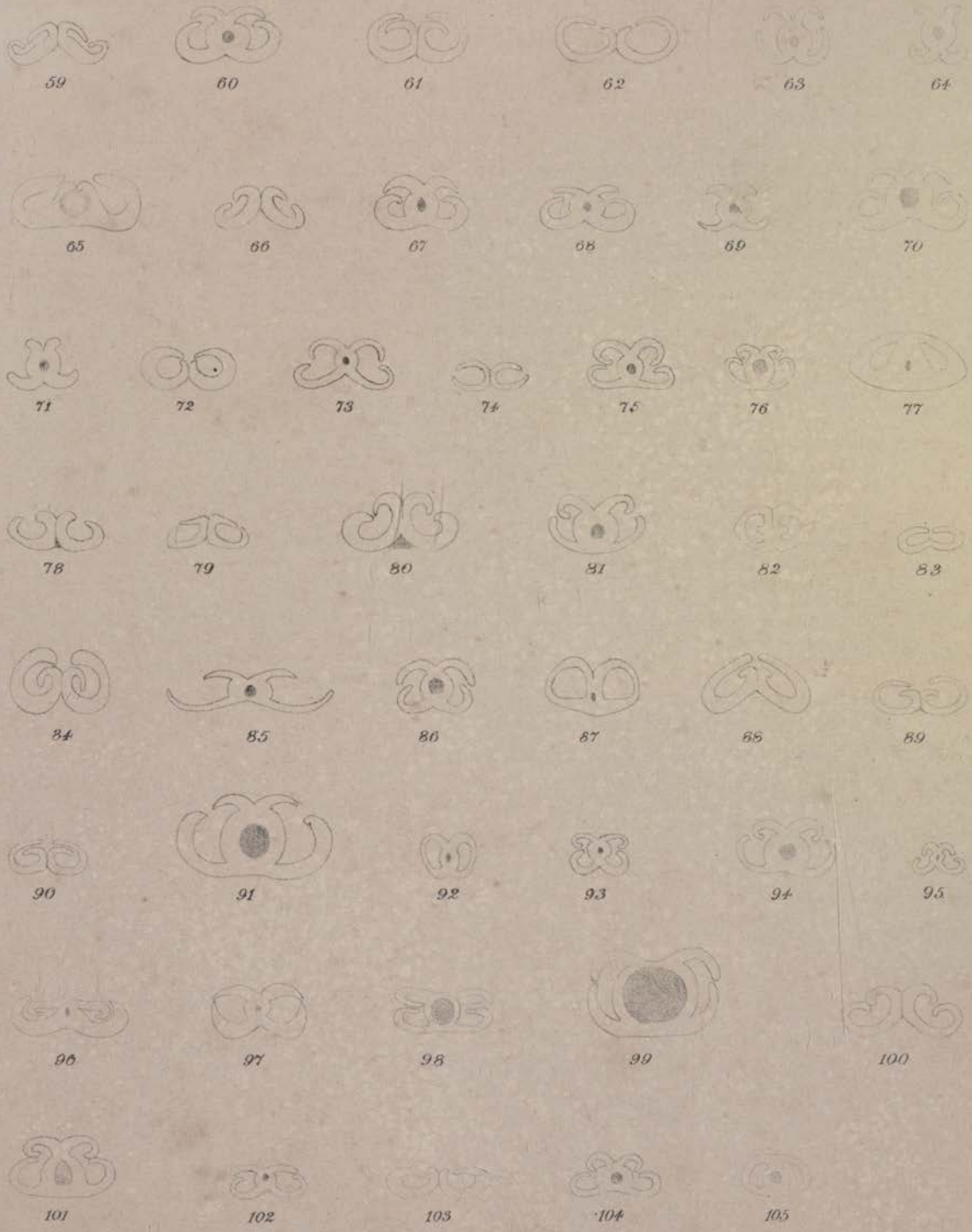
Explanation of Analytic Details.—1, unexpanded flower, the lid lifted; 2, longitudinal section of unexpanded flower; 3, stamens in situ; 4 and 5, back- and front-view of a stamen; 6, style and stigma; 7 and 8, transverse and longitudinal section of fruit; 9 and 10, sterile and fertile seeds; 11, portion of a leaf; all more or less enlarged.

EUCALYPTUS POPULIFOLIA.

The bye-following lithographic plate presents diagrams of anthers (after dehiscence) of many Eucalypts, pertaining to Bentham's series: Renantheræ, Heterostemones (Hemiantheræ), Porantheræ and Micrantheræ, in continuation of the transverse anther-sections (solely of the Parallelantheræ) given with E. tetraptera in the second decade.

Diametric augmentation 28 times.

59. Eucalyptus acmenoides, Schauer.
60. albens, Miquel.
61. amygdalina, Labillardière.
62. Baileyana, F. v. M.
63. Behriana, F. v. M.
64. Bowmanii, F. v. M.
65. buprestium, F. v. M.
66. capitellata, Smith.
67. Cloeziana, F. v. M.
68. coccifera, J. Hooker.
69. crebra, F. v. M.
70. Decaisneana, Blume.
71. drepanophylla, F. v. M.
72. eugenioides, Sieber.
73. gracilis, F. v. M.
74. hæmastoma, Smith.
75. hemiphloia, F. v. M.
76. largiflorens, F. v. M.
77. Leucoxylon, F. v. M.
78. Luehmanniana, F. v. M.
79. macrorrhyncha, F. v. M.
80. marginata, Smith.
81. melanophloia, F. v. M.
82. melliodora, Cunningham.
83. Eucalyptus microcorys, F. v. M.
84. obliqua, l'Héritier.
85. ochrophloia, F. v. M.
86. odorata, Behr.
87. paniculata, Smith.
88. pauciflora, Sieber.
89. pilularis, Smith.
90. piperita, Smith.
91. Planchoniana, F. v. M.
92. polyanthema, Schauer.
93. populifolia, Hooker.
94. pruinosa, Schauer.
95. Raveretiana, F. v. M.
96. rigida, Sieber.
97. Risdoni, J. Hooker.
98. salmonophloia, F. v. M.
99. salubris, F. v. M.
100. santalifolia, F. v. M.
101. sideiophloia, Bentham.
102. Sieberiana, F. v. M.
103. stellulata, Sieber.
104. trachyphloia, F. v. M.
105. uncinata, Turczaninow.



J. Rummel del. C. Troedel & Cº Lith. F. M. direxit. Steam Litho. Gov Printing Office, Melb.

Eucalyptus – Anthers, *transverse sections.*

EUCALYPTOGRAPHIA.

A DESCRIPTIVE ATLAS

OF THE

EUCALYPTS OF AUSTRALIA

AND THE

ADJOINING ISLANDS;

BY

BARON FERD. VON MUELLER, K.C.M.G., M. & PH.D., F.R.S.,

GOVERNMENT BOTANIST FOR THE COLONY OF VICTORIA.

"NON SUCCIDES ARBORIS, NEC SECURIBUS DEBES VASTARE EARUM REGIONEM."—*Liber Deuteronomii* xx. 19.

FOURTH DECADE.

MELBOURNE:

JOHN FERRES, GOVERNMENT PRINTER.

PUBLISHED ALSO BY GEORGE ROBERTSON, LITTLE COLLINS STREET.

LONDON:

TRÜBNER AND CO., 57 AND 59 LUDGATE HILL; AND GEORGE ROBERTSON, 17 WARWICK SQUARE.

M DCCC LXXIX.

Vatt del. T. Temple & Co. lith. T. & M. Arnold Steam Litho. Gov. Printing Office Melb.

Eucalyptus alba. *Reinwardt.*

Reinwardt, in Blume's Bijdragen tot de Flora van Nederlandsch Indie 1101 (1826); Decaisne, in Nouveaux annales du muséum d'histoire naturelle iii. 454; Spanoghe, in Schlechtendal's Linnæa xv. 203; Walpers, Repertorium botanices systematicæ ii., supplementum i. 927; Blume, Museum botanicum Lugduno-Batavum i. 83; Miquel, flora Indiæ Batavæ i. 398.

Tall; *leaves* scattered, on long stalks, *lanceolar- or rhomboid-oval,* gradually much elongated into the narrow apex, equally pale-green on both sides, not shining; oil-dots much concealed; lateral veins rather numerous, very spreading, circumferential vein more or less distant from the edge; umbels axillary or lateral, on a comparatively short somewhat angular stalk, with seven or fewer flowers; stalklets about as long as the calyx or somewhat shorter; *tube of the calyx semiovate-hemispherical, hardly as long as the semiglobular short-pointed smooth lid;* stamens all fertile, inflexed before expansion; anthers cuneate- or oval-oblong, opening by parallel slits; stigma not dilated; *fruits topshaped-hemispherical,* rather small, 3–4-celled, slightly or not angular; *rim flat; calces exserted;* placental axis not twice as long as broad, deltoid; seeds without appendage.

In Timor.

According to Blume's description some leaves occur occasionally blunt and the lid conical. As in Malayan language it is along with Melaleuca Leucadendron called Cajuputi, it may perhaps furnish a portion of the medicinal oil of that name. The leaves of specimens, gathered by the meritorious Mr. Teysmann of the Botanic Garden of Buitenzorg and kindly communicated by Dr. Scheffer, are of a thickly chartaceous but not leathery consistence and attain a breadth of 3 inches. The umbels, while in a very young state, are enveloped in a conical bract. Neither expanded flowers, nor matured seeds of Timor-specimens, were available for examination at this opportunity. From the material before me, it remains doubtful, whether really E. tectifica can be identified with this Timor-species; the bark of the Carpentaria-tree being persistent and rough as well on the branches as on the stem, though it is certainly also pale outside and is used by the Aborigines there for constructing the rude roofs of their sleeping places; the leaf-stalks are shorter, the leaves generally narrower, the umbels sometimes short-paniculate and terminal.

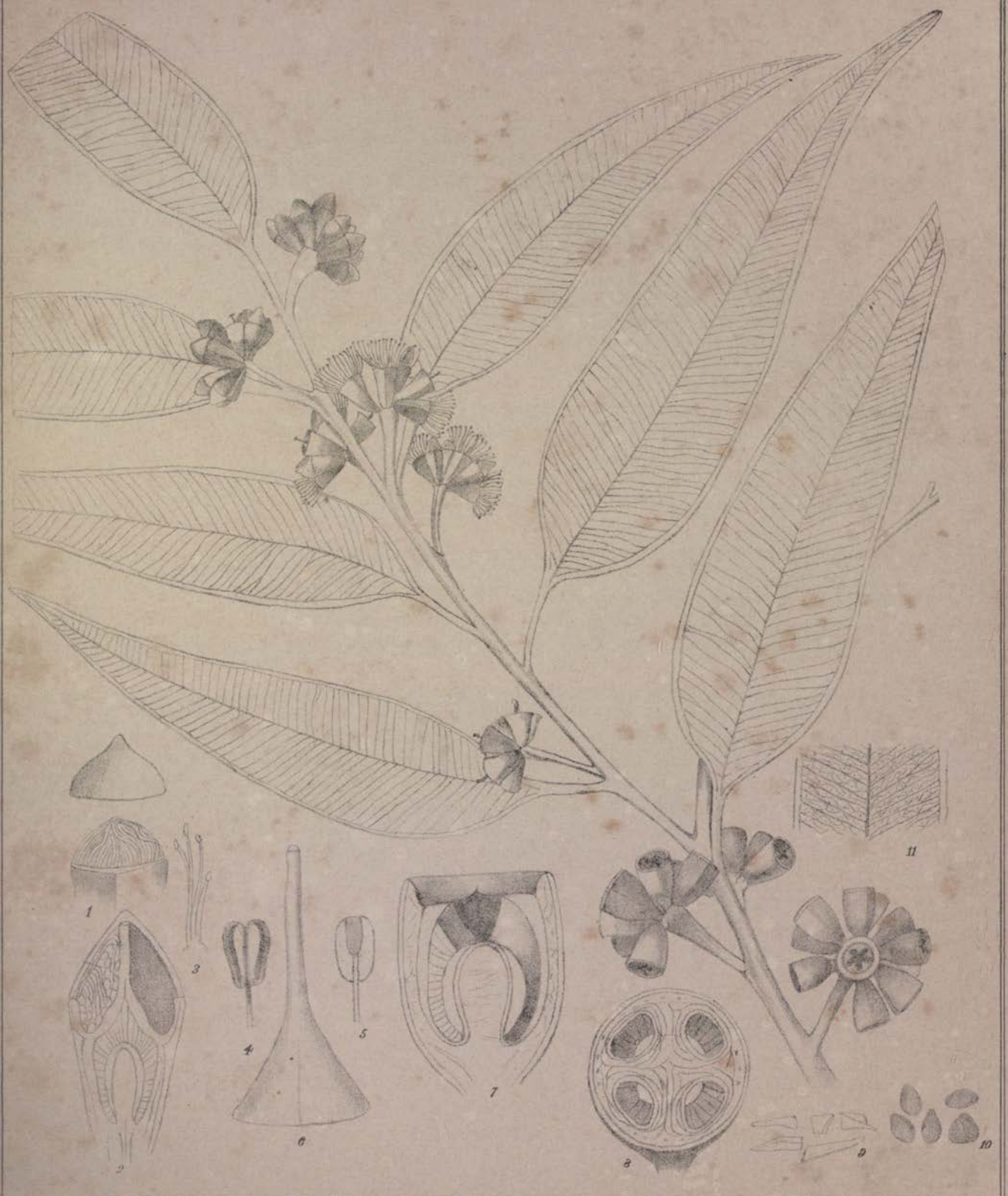
E. platyphylla (F. v. M., in the Journal of Proceedings of the Linnean Society iii. 93) approaches closely to E. alba; the leaves are mostly broader, the lid is generally shorter and blunt and the valves less exserted; its foliage sheds for short periods almost entirely. The range of variability of these trees remains yet to be further ascertained by extended field-researches.

The number of Extra-Australian species of Eucalyptus is extremely limited, so far as hitherto known, although additional congeners may perhaps yet be obtained from New Guinea, and even there possibly from alpine regions. With certainty we know from localities beyond Australia hitherto only E. alba, E. Moluccana (Roxburgh flora Indica ii. 498), E. Decaisneana (Blume, Museum botanicum Lugduno-Batavum i. 83), also from Timor, and E. Papuana (F. v. M., Descriptive Notes on Papuan Plants i. 8), which bears close affinity to E. clavigera. The existence of at least one more species in South-Eastern New Guinea has been placed beyond doubt; but of that the foliage has only yet been seen, in which respect it seems not to differ from E. alba. Indeed also E. Decaisneana, if rightly recognized, may prove only a variety of E. alba. E. Leucadendron (Reinwardt in De Vriese plantæ Reinwardtianæ p. 63) is according to Miquel l. c. 1085 synonymous with E. alba. Dr. Scheffer, informs me, that it has a white blurring bark, much resembling that of Melaleuca Leucadendron, and that the Timor name therefore is Kajoe-poetih.

(or White-tree), and that the tree can be grown on the plains of Java, where most other Eucalypts will not succeed. It is never a very tall tree and begins to flower already in the third year of growth. It may be added, that the bark of E. tectifica and allied Australian species is not lamellar like that of Melaleuca Leucadendron. The absence of Eucalypts in the native vegetation of New Zealand is under these circumstances all the more remarkable, though certainly a vast proportion of the flora of those islands is endemic. But an Eucalyptus-like tree has recently been recorded from New Ireland by the Rev. Mr. Brown as forming forests in that island.

This, like all other Eucalypts, passes in vernacular language as a "Gum-tree," an objectionable appellation, which should be banished and superseded by that of "Eucalypts," as first insisted on by the writer. The name "Gum-trees" would indeed be far better applicable to our native Acacias, which exude real gum as understood in chemical science and is quite identical with Gum Arabic, whereas the exudations of Eucalypts must be classed with the various kinds of Kino.

EXPLANATION OF ANALYTIC DETAILS.—1, unexpanded flower, the lid lifted; 2, longitudinal section of an unexpanded flower; 3 and 4, back- and front-view of a stamen; 5, style and stigma; 6 and 7, transverse and longitudinal section of fruit; 8 and 9, fertile and sterile seeds; 10, portion of a leaf; all more or less magnified.



R. Austin del. C. Troedel & Co Lith. F.v.M. direxit. Steam Litho Govt Printing Office Melb.

Eucalyptus botryoides. *Smith.*

EUCALYPTUS BOTRYOIDES. 32

Smith, in the Transactions of the Linnean Society of London iii. 286 (1796); De Candolle, prodromus systematis naturalis regni vegetabilis iii. 219; F. M., fragmenta phytographiæ Australiæ ii. 48 & 175; Bentham flora Australiensis iii. 229; E. platypodos, Cavanilles, icones et descriptiones plantarum iv. 23, t. 341 (1797).

Finally tall; branchlets angular; *leaves* scattered, elongate- or sickleshaped-lanceolar, rarely verging towards an oval form, above darker green and shining, *beneath paler and dull-greenish, lateral veins almost transversely spreading, close, subtle,* the circumferential vein near to the edge of the leaf; oil-dots much concealed or soon obliterated; *flowerstalks broadly compresssed,* axillary and solitary, sometimes crowded, seldom somewhat paniculated, bearing usually 4–9 flowers; *calyces almost or entirely devoid of stalklets,* not or somewhat angular; lid almost hemispherical, quite blunt or slightly pointed, about half as long as the almost obconic tube or rarely nearly as long; stamens all fertile; anthers nearly oval, opening by longitudinal slits; stigma hardly broader than the comparatively short style; fruits semiovate or hemiellipsoid, 3–5-celled, lined by slight angles or not angular; rim narrow; valves short, inserted close beneath the orifice, not emerging; seeds all without appendage, the sterile much narrower than the fertile seeds.

From Lake Tyers and the lower Snowy River through East-Gippsland to the southern portion of New South Wales, there westwards not crossing the Dividing Range, following mostly river-courses, but occurring also in moist sandy localities close to the seacoast. Probably it does not extend into Queensland, as the Blue Gum-tree mentioned from thence is referable to a species of the series of Leiophloiæ, probably E. saligna.

The shady and horizontal dark-green foliage of this beautiful tree give it among Victorian species quite a peculiar and imposing aspect, reminding rather of an Eugenia than an Eucalyptus. Stems will occasionally attain a height of 80 feet without a branch and a diameter of 8 feet. It is one of the few among its congeners, which with advantage can be utilized for wood-culture on coast-sands. Bark persistent on the stem and main branches, outside dark, wrinkled and somewhat furrowed. Wood light-brown. When the tree has arisen on rich soil along running streams its wood is regarded as one of the best among those of Eucalypts, and is then utilized for the manufacture of waggons, trucks, all the heavier kinds of wheelwrights' work, particularly felloes; it is also very eligible for shingles as water does not become discolored by them; when the tree grows on coast-sands its wood is still useful for sawing and fencing, though the stems occur there often gnarled (Kirton); sought also for knees of vessels or boats (Woolls); the timber is usually sound to the centre. The various accounts given of its durability under ground are contradictory.

It is rather unfortunate, that so unmeaning a name as "Bastard Mahogany" has found its way extensively into colonial language for the tree; the natives of East-Gippsland call it "Binnak," those near Port Jackson "Bangalay." The specific names given by Sir James Smith and the Abbé Cavanilles to this tree are nearly contemporaneous, that of the former—supposed to allude to the umbels sometimes (but indeed not frequently) grape-like crowded into bunches—being less expressive of the characteristics of this species, than the appellation given by the Spanish phytographer in allusion to the flatness of the flowerstalks.

It differs from E. goniocalyx in still more persistent bark, in the almost horizontal not nearly vertical turn of the leaves (resulting in a saturated green of their upper surface and in a paleness of the lower page as well as in hypogenous stomata only), further in their more numerous almost transversely spreading veins, somewhat blunter lid and generally rather less valves of the fruit;

but it resembles that species in its head-like umbels, the broad compressed two-edged flowerstalks and the form as well as structure of the fruit.

E. resinifera, compared to E. botryoides, shows the leaves rather narrower, the flowerstalks not quite so broad, the calyces provided with distinct stalklets, the lid conical and more elongated, the fruits comparatively shorter with their valves exserted.

E. saligna is in nature easily enough distinguished by the smoothness of its bark, which secedes in its outer layers successively; otherwise the differences are slight, consisting in the often somewhat longer lid and in fruits with half exserted valves.

E. robusta is known as distinct from E. botryoides by the larger size of the flowers and fruits and often also the leaves, by the more extended flowerstalks and particularly by the longer-pointed pale never shining lid, which at the base is broader than the calyx-tube, and by the longer fruits with comparatively narrow and almost permanently coherent valves.

EXPLANATION OF ANALYTIC DETAILS.—1, upper portion of unexpanded flower, the lid lifted; 2, longitudinal section of an unexpanded flower; 3, stamens in situ; 4 and 5, front- and back-view of an anther with portion of filament; 6, pistil; 7 and 8, longitudinal and transverse section of fruit; 9 and 10, sterile and fertile seeds; 11, portion of a leaf; all magnified, but in various degrees.

Tuff del. C.Troedel & Co Lith

P. v. M. direxit

Sleam Litho Gov. Printing Office Melb

Eucalyptus clavigera *Cunningham.*

EUCALYPTUS CLAVIGERA. 33

Allan Cunningham, in Walpers repertorium botanices systematicæ ii. 926 (1843); F. M., in the Journal of the Proceedings of the Linnean Society iii. 98; Bentham, flora Australiensis iii. 250.

Arborescent, not tall; *young branchlets often hairy-rough; leaves partly opposite and sessile*, partly scattered and short-stalked, either from a cordate or roundish base orbicular- or lanceolar-oval or from a short attenuated base oblong- or elongate-lanceolar, not shining; lateral veins prominent, very spreading, rather distant, the circumferential vein removed from the edge or partly confluent with it; *umbels crowded into mostly compound and lateral corymbs; stalks short; stalklets very slender, usually longer than the flowers; unopened calyces pearshaped; lid depressed-hemispherical*, shining, much shorter than the tube of the calyx; stamens all fertile, deeply inflexed while in bud; anthers oblong-oval, opening by longitudinal slits; stigma not dilated; fruits hemiellipsoid, slightly urnshaped, generally 3-celled, not angular; *rim very narrow, valves deeply enclosed;* seeds without any appendage.

From the most northern regions of Western Australia along some of the coast-tracts of Arnhem's Land to Carpentaria, in sterile country.

A small tree (so far as known), flowering already while yet a shrub. Leaves somewhat wavy flexed, of a dull greyish hue; their lateral veins ascendingly curved, passing successively into the edge of the leaf and constituting an interrupted intramarginal vein; the veinlets closely reticular, the ultimate areoles between them exceedingly small and somewhat pellucid from elongated pores but not well defined oil-dots. It is left to future labors to elucidate fully the microscopic anatomy of Eucalyptus-leaves in mutual contrast of various species, by which researches some of the specific forms of the genus are likely to become still better defined. Stomata isogenous. Ultimate umbels containing six or fewer rarely more flowers; tube of the calyx not angular, rather suddenly dilated upwards; lid very smooth, almost membranous, quite blunt, or raised at its centre into a minute point, not rarely shortened to a patellar form.

Name of the species from the somewhat club-like form of the united flowerbud and its stalklet.

Bentham very properly places E. clavigera next to E. grandifolia and E. tesselaris. In the botanic collections, formed by Mr. Schultz at Port Darwin, specimens of E. grandifolia occur, which show the leaves more generally opposite, all conspicuously stalked and all broad, the flowers larger on still longer and also stronger stalklets, the lid broader, not shining, somewhat wrinkled, more convex and prominently pointed; fruit is not available for comparison. E. tesselaris differs in all the branches being smooth, the leaves all scattered and narrow with closer veins, the flowers smaller on short stalklets and also generally fewer in each individual umbel and perhaps in its tesselar semipersistent bark. E. Papuana may not really be distinct as a species from E. clavigera, as pointed out formerly (F. v. M., Descriptive Notes on Papuan Plants i. 8), but the tree from New Guinea is as yet imperfectly known, and we here are quite unacquainted with the characteristics of its bark, on which for due discrimination of Eucalypts so very much depends. Should E. Papuana prove identical with E. clavigera, we might then assume, that the Extra-Australian species had all emigrated perhaps through the agency of migratory birds, as even E. Decaisneana (if correctly here identified) may be only an extreme variety of E. alba, and as moreover the few phyllodinous Acacias known from New Guinea and the adjoining islands represent not endemic types but merely reappearing identical Australian forms.

An opportunity is offered to refer here generally to the Eucalypts of Northern Australia, so far as they are hitherto known. The shrubby desert-species are as yet not much gathered in the

few geographic journeys through the sandy and waterless regions, in which they often constitute a considerable proportion of the vegetation, and where their general monotony of forms is apt to conceal the variety of their specific types to hurriedly passing and perhaps harassed travellers. It is fair to assume, that some of these dwarf Eucalypts are likely to prove identical with extra-tropical congeners, inasmuch as already in 1856 I traced a considerable number of the desert-shrubs of the regions, pertaining to the Murray-River and its tributaries, as far as 20° north latitude.

Among the timber-trees of North-Australia E. rostrata is one of the tallest and the most valuable; but none of the species reach there the gigantic dimensions of several of their southern congeners, unless E. Abergiana, E. Torelliana and possibly a few others on the litoral slopes of the Dividing Range in North-Queensland, where the jungles have as yet been but very imperfectly traversed. The following are the species, which hitherto became known from North-Australia :—Eucalyptus Abergiana, E. alba, E. aspera, E. brachyandra, E. clavigera, E. Cloeziana, E. crebra, E. dichromophloia, E. exserta, E. ferruginea, E. grandifolia, E. latifolia, E. leptophleba, E. maculata, E. melanophloia, E. microtheca, E. miniata, E. odontocarpa, E. oligantha, E. pachyphylla, E. pallidifolia, E. patellaris, E. perfoliata, E. phœnicea, E. platyphylla, E. populifolia, E. pruinosa, E. ptychocarpa, E. resinifera, E. rostrata, E. setosa, E. tereticornis, E. terminalis, E. tesselaris, E. tetrodonta, E. Torelliana. The sections Renantheræ and Hemiantheræ are, as far as hitherto known, not represented in North-Australia.

Explanation of Analytic Details.—1, unexpanded flower, the lid lifted; 2, longitudinal section of an unexpanded flower; 3, stamens in situ; 4 and 5, front- and back-view of an anther with part of filament; 6, style and stigma; 7 and 8, longitudinal and transverse section of a fruit; 9 and 10, fertile and sterile seeds; 11, portion of a leaf; all more or less magnified.

Test. del. G Ingoldsby & Co Lith

F v M. direxit

Steam Litho Cor Printing Office Melb

Eucalyptus Doratoxylon. *F.v.M.*

EUCALYPTUS DORATOXYLON. 34

F. v. Mueller, fragmenta phytographiæ Australiæ ii. 55 (1860); Bentham, flora Australiensis iii. 249; F. v. M., select plants for industrial culture and naturalization p. 78; Indian Edition p. 111.

Shrubby, finally arborescent; *leaves small, opposite, linear- or narrow- lanceolar, on very short stalks*, slightly or hardly curved, equally green on both sides, not conspicuously dotted; lateral veins faint, rather close, moderately or much spreading, the circumferential vein evidently removed from the margin of the leaf; *umbels bent downward, on recurved slender compressed stalks*, solitary, axillary or soon lateral, with 4 to 8 flowers; stalklets thin, angular, usually about as long as the tube of the flowering calyx, but shorter than the fruit; lid smooth, below semiovate-hemispherical, conspicuously terminated into a beak-like point, rather longer than the obverse-conical or hemi-ellipsoid not angular tube; stamens inflexed before expansion; *outer filaments without anthers;* fertile filaments very short; anthers very minute, nearly oval, opening by longitudinal slits; width of the stigma hardly exceeding that of the style; fruits small, broadly truncate-ovate or verging towards a spherical form, slightly wrinkled, 3- rarely 4-celled; their rim narrow; *valves enclosed*, but reaching nearly or fully to the rim, very short; seeds extremely small, all without appendage, the sterile seeds not very narrow.

From Lucky Bay (R. Brown), Cape Arid and Russell's Range (Maxwell) to Stirling's Range (F. v. M.) and Mount Lindsay extending to the most south-eastern sources of Swan-River (Muir), mostly in rich soil along brooks, reaching the summits of mountains up to 3,000 feet elevation.

A tree, with a smooth stem, which attains 3 feet in diameter (Th. Muir), and with a comparative small crown of foliage, not dissimilar in habit to E. salubris and E. salmonophloia (concerning which two species may be referred to my "Report on the Forest-resources of Western Australia," pages 13–14, pl. 14 and 15), fruiting sometimes already as a shrub of 6 feet; growth not of celerity, about 40 feet in 20 years. Bark greenish-white. Leaves not much shining, as in very many congeners terminated by a curved narrow acumen; occasionally some of the leaves displaced and not paired; reticular veinlets rather conspicuous and very close. Buds of the umbels enclosed in two connate bracts. Umbels when in fruit usually less turned downwards than when in flower. Valves inserted not distant from the orifice.

The Aborigines of Western Australia wander for long distances to obtain saplings of this species for their spears, on account of the straightness of the stem and the hardness and elasticity of the wood; hence the specific name and the vernacular "Spearwood-Eucalypt."

E. Doratoxylon approaches in systematic affinity to E. decurva, as pointed out by Bentham, who also justly observes, that both come near the Micrantheræ, to which along with E. oleosa and its allies they might be readily referred, though placed by that illustrious phytographer into the series Normales (Parallelantheræ). The differences between E. Doratoxylon and E. decurva consist in the mostly scattered and also broader leaves of the latter, the longer leafstalks, the larger umbels with longer stalklets, the depressed lids, the filaments more sharply refracted while in bud, the longer anthers and somewhat larger fruits.

This pretty tree was introduced into the Melbourne botanic garden very many years ago.

Explanation of Analytic Details.—1, an unexpanded flower, the lid lifted; 2, longitudinal section of an unexpanded flower; 3, some stamens in situ; 4, 5 and 6, side-, front- and back-view of an anther, with portion of filament; 7, style and stigma; 8 and 9, transverse and longitudinal section of a fruit; 10 and 11, fertile and sterile seeds; all magnified, but in various degrees.

The chemical analysis of the leaves (by Mr. Rummel under the author's direction) gave the following results :—

I. From lead-precipitate, insoluble in diluted acetic acid,
Eucalypto-tannic acid, not soluble in ether.

II. From lead-precipitate, soluble in diluted acetic acid,
Eucalyptoic acid, soluble in ether,
Fruitsugar, soluble in alcohol but not in ether,
Gum, soluble in water, but neither in alcohol nor ether.

III. From aqueous solution, not precipitable by subacetate of lead,
Eucalyptin, soluble in ether,
Fruitsugar,
Gum.

The percentage of these substances in dried leaves proved to be as follows :—

Eucalypto-tannic acid	7·01
Eucalyptoic acid	·20
Eucalyptin	·22
Fruitsugar	5·41
Gum	7·64

It will thus be observed, that unlike in leaves of E. rostrata, gallic acid is absent in those of E. Doratoxylon, that the percentage of Eucalypto-tannin and gum is greater, but that of fruitsugar less.

Tuckfield del. C Troedel & Co Lith.

F.v.M. direxit.

Steam Litho Gov. Printing Office Melb.

Eucalyptus Gunnii. *J. Hooker.*

EUCALYPTUS GUNNII. 35.

J. Hooker, in the London Journal of Botany iii. 499 (1844); flora Tasmanica i. 134, t. 27; F. v. M., fragmenta phytographiæ Australiæ ii. 62; Bentham, flora Australiensis iii. 246: E. acervula. J. Hooker, flora Tasmanica i. 135.

The Swamp-Gum-tree or Cider-Eucalypt.

Leaves scattered, oval- or oblong- or elongate-lanceolar or almost oval, acute at the base and apex, *not very inequilateral*, rigid, shining and of equal and saturated green on both sides, their oil-dots concealed or hardly developed, their lateral veins slightly prominent, somewhat distant and moderately spreading, the circumferential vein distinctly removed from the edge of the leaf; umbels solitary, axillary and lateral, 3–10-flowered; stalklets usually short or even hardly any, seldom much elongated; tube of the calyx obconical-semiovate or faintly bellshaped, from slightly to doubly exceeding the length of the mostly hemispheric and short-pointed lid; stamens all fertile, inflected before expansion; anthers almost oval, bursting by longitudinal parallel slits; style short; stigma depressed; *fruits topshaped-semiovate*, seldom slightly bellshaped, not angular, 3–4- or rarely 5-celled; *rim rather narrow;* valves very short, deltoid, fixed close to the orifice, almost enclosed; seeds all without appendages.

From the vicinity of Guichen-Bay and Lake Bonney eastward to Gippsland, on alluvial flats particularly in swampy places, but also on the sides of moist forest-hills and silvan mountains, ascending in a dwarf state our alpine regions up to 5,500 feet height, extending at least as far as Berrima into New South Wales (Woolls), frequent in Tasmania.

A tree, rising under most favorable circumstances to a height of 250 feet, but usually not tall, often of crooked growth, sometimes also dwarfed and exceptionally even somewhat procumbent on coast-ridges, passing not unfrequently as a White Gum-tree, also occasionally under the designation Yellow Gum-tree. Bark constantly under the process of separation (Howitt), rough and dark- or greyish-brown at the butt or also on a portion of the stem or even sometimes up to some of the main limbs, or in many cases smooth on the stem as well as on the branches, then greyish or verging into a yellowish or brownish coloration. Hence the tree fluctuates in its cortical characteristics between Leiophloiæ and Hemiphloiæ. Wood hard, very good for many purposes of artisans, if straight stems are obtainable, as a rule not splitting well, but fair for fuel. Branches very spreading. Mass of the foliage more dark, dense and shady than in many other Eucalypts. Leaves shorter and comparatively broader and also stiffer in the alpine state of the species, often somewhat undulated in the large lowland-form, occasionally and more particularly towards the margin assuming a reddish tinge. Stalks usually shorter than the umbels, more or less angular, but not dilated, sometimes almost obliterated, bearing in the alpine variety occasionally merely two or one flower, only in abnormal rare instances a few umbels crowded into panicles. Lid occasionally very depressed and almost blunt, in other exceptional cases upwards nearly conical. The calyces and young branches of plants of the coldest regions not rarely covered with a whitish bloom. Leaves of young seedlings opposite, roundish, powdery-whitish or in the tall variety not pruinous. In the Alps this species flowers already at a height of several feet, forming there, associated with dwarfed E. pauciflora, mainly the miniature-forests; a shrubby state producing flowers may now and then also be met on coast-borders. The foliage has not decidedly the penetrating strong Cajuput-odor of most congeners; hence cattle and sheep readily browse on it, a circumstance very unusual among Eucalypts, though noticed also in the case of E. corynocalyx.

The sap of at least the alpine variety has a not unpleasant taste, and bush-people have converted it occasionally into a kind of cider.

Our Swamp-Gum-tree has been confined on this occasion within the same specific limits, assigned to it (fragmenta phytographiæ Australiæ ii. 62) in 1860, although Bentham restricted E. Gunnii to the highland-form, and kept apart from it the tall lowland-state of the species with larger and particularly more elongated leaves, with generally more flowers in each umbel on longer stalks and stalklets, and with rather more topshaped not somewhat bellshaped and usually also smaller fruits. Middle forms can however be traced through the different regions of altitude, inhabited by this species. These observations were confirmed in Tasmania by Mr. F. Abbott, who noted, that E. Gunnii descends there to about one thousand feet of the sea-level and forms then trees up to 150 and even 200 feet high. But in the Flora Australiensis iii. 243 the lowland-variety of E. Gunnii was united with E. Stuartiana as now understood; the discrepancies between the two are set forth in the text of the last mentioned species. In their native haunts these two kinds of trees can be much more easily distinguished, than is possible from branchlets in Museum-collections. A confusion with E. viminalis, contrasted on the same occasion, is much less likely.

Miquel (Nederlandisk Kruitkundig Archiev iv. 1859) referred states of E. Gunnii doubtfully to E. ligustrina of Candolle, E. Baueriana of Schauer and E. persicifolia of Loddiges.

A solitary experiment gave the percentage of Kino-tannin in the bark of E. Gunnii as 3·44: hence the yield is not likely under any circumstances rich. The following are results in this respect obtained from other congeners: E. amygdalina 3·22–3·40; E. globulus 4·84; E. goniocalyx 4·12–4·62; E. Leucoxylon 21·94; E. macrorrhyncha 11·12–13·41; E. melliodora 4·03; E. obliqua 2·50–4·19; E. polyanthema 3·97; E. rostrata 8·22; E. viminalis 4·88–5·97.

Explanation of Analytic Details.—1, an unexpanded flower, its lid lifted; 2, longitudinal section of the same; 3, some stamens in situ; 4, 5 and 6, back-, side- and front-view of an anther, with portion of its filament; 7, style with stigma; 8, longitudinal sections of fruit; 9, transverse sections of fruit; 10 and 11, fertile and sterile seeds; 12, portion of a leaf; all magnified, but to various extent.

F.Mueller del et Lith. Baron von Mueller direxit. Steam. Litho. Gov. Printing Office Melb.

Eucalyptus Planchoniana. *F.v.M.*

EUCALYPTUS PLANCHONIANA. 36

F. v. M., fragmenta phytographiæ Australiæ xi. 43 (1878).

Branchlets very angular; leaves scattered, sickleshaped-lanceolar, prolonged into a narrow apex, slightly less shining beneath, not pellucid-dotted, with subtle much spreading not crowded veins, the circumferential vein somewhat removed from the edge; flowers 3–7 together on solitary axillary *broadly compressed stalks;* stalklets thick, very short or hardly any; tube of the calyx cylindrical-semiovate, furrowed; *lid from a semiovate base narrow-conical, about as long as the tube, both longitudinally streaked;* stamens all fertile; anthers ovate- or roundish-cordate, opening with longitudinal slits; style rather long; stigma not dilated; *fruit comparatively large, globose-ovate, truncated,* 3–4-celled, streaked by angular lines; their margin narrow, vertically descending; valves short, deltoid, rather deeply enclosed; seeds without any appendage, the sterile not much smaller than the fertile seeds.

On arid somewhat sandy or more particularly rocky ridges near Moreton-Bay (Bailey).

Height of tree up to about 100 feet; diameter of stem to 3 feet. Timber sound, heavy, hard and durable, well adapted for sawing, but not easy to split. The foliage is massive and hence the tree more shady than many other Eucalypts. (Bailey.)

This species bears similarity chiefly to E. rigida var. Luehmanniana; the latter differs however in the whitish bloom of its branchlets, flowerstalks and calyces, in leaves of thicker consistence with less divergent and more prominent veins, in the presence of stomata in about equal number on both pages of the leaves (E. Planchoniana having them only on the underpage and there more copiously too, about 165,000 to a square inch), in the rather shorter and still broader flowerstalks, in somewhat shorter calyces with more pointed lids, in broader anthers with more divergent slits and a smaller gland, in fruits of less size, not at all contracted at the summit, with more numerous cells and a broad convex rim, in valves not deeply enclosed, but originating at the orifice, and in the seeds being smaller. The affinity of E. incrassata is more remote. In some respects E. Planchoniana reminds of E. pilularis, notwithstanding the much larger flowers and fruits, the almost total absence of stalklets, the heartshaped anthers and the more prominent rim of the fruit-calyx.

The dedication of this stately species is to Dr. J. E. Planchon, Member of the Institute of France, Director of the Botanic Garden of Montpellier, famed not only for his researches on the Phylloxera, but also for his extensive phytologic writings, who was one of the first to cultivate Eucalyptus globulus and other important congeners on the shores of the Mediterranean Sea, and who wrote an important article on Eucalyptus-culture in the Revue des Deux-Mondes, Janvier 1875.

With the quality of the wood of E. Planchoniana we remained hitherto unacquainted, but doubtless it serves for many of those technic purposes, for which the ordinary Australian Hardwoods are applicable. In a Report on the Vegetable Products of the Intercolonial Exhibition of 1866–1867 I already recorded, that wood-vinegar, alcohol, and tar, are obtainable from all kinds of Eucalyptus-wood (and indeed from *any* kind of wood) through dry distillation, hence also from E. Planchoniana, though its timber may prove too valuable to be sacrificed for such purposes. The percentage of these educts from Eucalypts is rather uniform, provided the temperature, at which the decomposition of the wood is effected, remains at an uniform standard. It is therefore not merely from E. rostrata, E. Leucoxylon and E. obliqua that tar is obtained, although these species were among those, which I singled out for the experiments (conducted by Mr. C. Hoffmann.

under my directions), simply because their wood is very extensively available in Victoria, and largely went to waste; whereas a document, presented not very long ago to Parliament in a neighboring colony and reproduced in the Transactions of the Botanical Society of Edinburgh, vol. xiii. pag. lxv.–lxvi., and in some other journals, would lead to the impression, that only the three above-named Eucalypts furnish wood-vinegar (and therefore acetic acid) and tar (and therefore also pitch and empyreumatic oils). In the same manner *all* Eucalypts are pervaded to a greater or lesser extent by Cajuput-like oil, but E. viminalis is particularly among the poorest in yield of this oil, as proved in the Victorian experiments made by Mr. Osborne, Mr. Bosisto and Mr. W. Johnson on the writer's suggestions for former exhibitions. Again I caused paper to be prepared in my laboratory from the bark of the above noticed species of Eucalyptus, not because that they alone furnish the raw material, but because they were simply for us most handy at the time for at random demonstrating by a few examples of what indeed holds good for a great genus of trees with numerous species. Extra-samples of these preparations were freely distributed to museums of vegetable products also in the adjoining colonies.

The Kino of E. Planchoniana is one of very great astringency and therefore particularly valuable for therapeutic purposes; after adherent impurities are removed by alcohol, it is found to be composed mainly of Kino-tannic acid, the percentage being 93·88 of that acid, the rest (6·12) consisting simply of real gum and seems quite free of gallic acid. Kino-tannic acid differs from the allied Eucalypto-tannic acid (occurring in the leaves of Eucalypts) by producing a dark-blue (instead of a green) precipitate with chlorid of iron.

The aged wood of E. Planchoniana contains,—as far as a solitary experiment has shown,—6,900 vascular tubes and 270 medullary rays within a square inch; the largest diameter of the prosenchyma cells proved 00094,—the thickness of their cell-walls 00050 inch.

EXPLANATION OF ANALYTIC DETAILS.—1, upper portion of an unexpanded flower, the lid separated; 2, longitudinal section of an unexpanded flower; 3, stamens in situ; 4 and 5, front- and back-view of an anther with portion of the filament; 6, style and stigma; 7 and 8, transverse and longitudinal section of fruit; 9 and 10, sterile and fertile seeds; all more or less magnified, but in various degrees.

Ted. del.

Baron von Mueller direxit.

C. Troedel & Co. imp.

Eucalyptus rostrata, *Schlecht.*

Schlechtendal, Linnæa xx. 655 (1847); F. v. M., in the Journal of the Proceedings of the Linnean Society iii. 83; Bentham, flora Australiensis iii. 240; F. v. M., forest-resources of Western Australia p. 9 (1879); E. acuminata, Hooker, in Mitchell's Journal of an Expedition into Tropical Australia 390 (1848); E. brachypoda, Turczaninow, in Bulletin de la Société Imperiale des Naturalistes de Moscou 1849 iii. 21, not of Bentham.

Finally tall; branchlets slender; leaves scattered, lanceolar-sickleshaped, of equal color on both sides; lateral veins rather subtle, crowded, pinnate-spreading; the circumferential vein somewhat removed from the edge; oil-dots scanty or obscured; umbels axillary or lateral, solitary, on slender stalks, usually with from 4 to 14 flowers; stalklets thin, variously shorter than the calyx or sometimes nearly as long; *lid longer than the semiglobular tube of the calyx, from an almost hemispheric base gradually or suddenly sharp-pointed* or rarely almost blunt; stamens all fertile; anthers nearly ovate, bursting with longitudinal slits; stigma not dilated; *fruit roundish in outline from the hemispheric calyx-tube, the broad protruding convex rim and the* 3 *or oftener* 4, *rarely* 5 *high-exserted deltoid valves*, not large; seeds small, all without any appendage, the sterile seeds very narrow.

Along river-banks or in alluvial valleys throughout nearly the whole Australian continent, but absent from some of the coast-country, from the extreme of South-West Australia and altogether from Tasmania, nowhere ascending high mountain altitudes, nor occurring away from moist oases in any desert-regions, reaching the coast-borders in Victoria, South-Australia and also at least occasionally in South-Queensland, traced by me likewise to litoral tracts on the lower Victoria-River in Arnhem's Land and in West Australia south to the Murchison-River.

This species, our famous "Red Gum-tree," is perhaps the most important of the whole genus; although surpassed in celerity of growth by E. globulus, it is of higher value for the extraordinary durability of its timber, having in this respect perhaps a rival only in E. marginata of South-West Australia, but excelling that celebrated tree in increased rapidity of growth and in the greater ease, with which it can be reared even in grounds with stagnant humidity. It never becomes so tall as the surpassingly gigantic states of E. amygdalina, E. diversicolor or E. obliqua; but often attains a height of over 100 feet, and is said to have reached under particularly favorable circumstances even more than double that height, 250 feet according to Mr. Falck. The stem is proportionately stout, yielding a great bulk of timber, a diameter of 14 feet being on record. The bark is smooth, ashey-grey or whitish, or occasionally in part slightly brownish, from early decortication of its darker outer layers, unless it should remain persistently rough on the base of the stem, or should in trees growing exceptionally on dry ridges be more persistent and less smooth. The tree will live even in permanent shallow swamps.

As this tree on account of its incomparably valuable timber will be made the subject of many cultural efforts and experimental tests here and abroad, many additional observations concerning this species will likely be instituted for many years to come, which can in time also be collected in supplementary pages for these Eucalyptus decades. Even in California, where the indigenous forests supply the most magnificent timber-pines of the globe, it is found far more advantageous to rear Eucalyptus-wood for fuel and for many other purposes, for which it is adapted, than to grow fir-wood. E. rostrata carries with it the recommendation of being one of the best of its congeners to resist wet tropical heat. Thus in Mauritius it grew 50 feet in sixteen years. The vernacular name of "Red Gum-tree" is derived from the dark reddish-brown color of the wood, the specific appellation from the beak-like pointed lid of the calyx. The natives of the lower Murrumbidgee call it "Biall." The leaves verge exceptionally into an oblong- or oval-lanceolar form; they are

neither very shining, nor of very dark-green, indeed not rarely of a dull and pale hue, particularly in arid regions of the interior. The umbels are sometimes crowded, but never strictly paniculated. A narrow and elongated outer quickly deciduous operculum covers not rarely the normal lid.

The writer gave to this tree already in 1847 the name of E. longirostris, before that bestowed by Schlechtendal was published; and as the now generally adopted designation had been anticipated by the Abbé Cavanilles (for the previously established E. robusta), the name E. longirostris found its way into several publications, for instance the Nederlandisk Kruitkundig Archief of 1859, p. 125. On the whole this is one of the most easily recognized of all species; still instances occur, when it merges almost into E. viminalis and completely into E. tereticornis; indeed from a strictly phytographic view it should be considered merely a variety of that species, but for convenience sake and practical purposes the specific name may well be retained for so important a tree as this. It is also almost linked by exceptional transit-forms with E. rudis, which takes its place in litoral South-West Australia, while E. tereticornis replaces it in many coast-tracts of Queensland, New South Wales and Gippsland. The only differences of E. tereticornis consist in the generally more elongated and often blunter lid of the calyx, very gradually tapering upwards, constituting a narrow cone, and in the perhaps rather more protruding summit of the fruit; the filaments are also often straight while in bud, as in E. cornuta and its allies, through not being forced to inflexion within the long cavity of the lid. In respect to the fruit E. exserta approaches closer to E. tereticornis than to E. rostrata, differing from both in the persistency of its outside wrinkled and rough, inside somewhat fibrous bark; both E. tereticornis and E. exserta have the stalklets often thicker and shorter than E. rostrata. E. exserta, the "Bendo" of the Aborigines (O'Shanesy), is now known to range from the Burnett- to the Gilbert-River, but does not extend to West Australia. The main distinctions of E. viminalis consist in its having typically only three flowers to each stalk, in the generally shorter stalklets, in the lid being never contracted into a long beak-like acumen and in the valves not being so much elevated above the margin of the fruit-calyx by the intervening rim. In E. rudis the bark is extensively persistent and rough, the leaves are often broader, hardly so regularly and distinctly feather-veined, the flowers are fewer in the umbels and mostly larger, the calyces are often dark-colored, the lid is almost conical, the half-ripe fruit somewhat bellshaped on account of its prominent narrow slightly expanding margin, the ovary is then more sunk, the ripe fruit is usually larger, less or not rounded at the summit, but rather semiovate, not very convex, nor very wide at the rim, by which means the exserted portion is more evidently shorter than the tube of the fruit-calyx, or the valves may remain even half enclosed; to these distinctions may be added, that the leaves of young seedlings are roundish and almost sessile, not narrow-lanceolar as in E. rostrata. The distinction of E. patellaris is still more evident.

E. rostrata supplies our well known Red Gum-timber, which is so highly prized for its unsurpassed durability, especially under ground; it is very dense and in its grain flexuous but comparatively short, bearing an enormous downward pressure and is but slightly subject to longitudinal shrinking; it remains for very long periods indestructible in fresh or salt water or in wet ground. Its principal uses are for railway-sleepers, telegraph poles, fence- and other posts, piles, bridge-planks, culverts, wheelwrights' work (especially felloes), engine-buffers; shipbuilders employ it extensively for main-stem, stern-post, inner post, deadwood, floor-timbers, futtocks, transoms, knighthead, hawse-pieces, cant-, stern-, quarter- and fashion-timber, bottom planks, breasthooks and riders, windlass, bowrails &c.; it should be steamed before it is worked for

curving. Next to the Jarrah from West Australia it is the best to resist the attacks of the Teredo and Chelura and Termites. It takes a good polish and may thus be used for furniture, though it is rather heavy and difficult to work on account of its great hardness. The specific gravity of Red Gum-wood ranges from 0·858 to 1·005, or from 53½ to 62½ lbs. per cubic foot. Mr. F. Campbell found the tensile strength to be equal to a pressure of 14,000 to 21,500 lbs. per square inch. A ton of dry wood has yielded as much as 4 lbs. of pearlash or 2¼ lbs. of pure potash. For further details see the reports of the jurors of the successive great Melbourne Exhibitions, from which part of the above notes was obtained.

Dr. H. Nördlinger of Hohenheim has given in the sixth part of his "Querschnitte von Holzarten" (1874, p. 19) a short anatomic description of the wood of E. rostrata.

Dr. Josef Moeller of Marienburg has subjected this wood to a fuller anatomic examination. We all find the medullary rays flexuous, very numerous and fine, formed by one, two or three rows of cells, which are thin-walled, considerably longer than broad, and where they approach the vascular tubes dotted by pores; the concentric rings are indicated by the alternating greater and lesser number of the vascular tubes or their absence; the latter isolated, on transverse sections their walls are circular or elliptical, with an average diameter of 0·15 millimeter; they are also copiously dotted, comparatively not thick, and contain often thin-walled cells with red-brown particles, which are soluble in a solution of caustic potash; these are contained also in the other elements of the wood; the parenchyma-cells are rather scantily dispersed but increased in number around the vascular tubes, without however completely surrounding them, not much thicker than the wood-fibres, but somewhat porous and with ampler cavity; wood-fibres of an average width of 0·015 millimeter, thick-walled and dotted, mostly attenuated into a fine extremity, often curved and occasionally ramified, some forming a solitary line between any double row of medullary rays.

The fresh bark contains from 7 to 8 per cent. Kino, which for therapeutic purposes is regarded as one of the most efficient of its kind. The air-dried wood of E. rostrata contained according to one experiment 4·38 per cent. of Kino-tannin and 16·62 per cent. of Kino-red; the latter (allied to Phlobaphen) is soluble in alcohol but not in water; the large percentage of these two substances in our Red Gum-wood is only rivalled, as far as known, by that of the hardest kind of Jarrah-wood (from E. marginata), and we have thus a clue to the extraordinary power of these two kinds of wood to resist decay in water and under ground and to be impervious to boring insects or crustacea. The fresh leaves, chemically analysed for their organic constituents by Mr. L. Rummel under my direction, contain: Eucalypto-gallic acid ·88, eucalypto-tannic acid 4·68, eucalyptoic acid ·16, gum 2·50, eucalyptin ·72, fruitsugar 10·42. The mode of operation for the chemical analysis of eucalyptus leaves, adopted on this occasion, was the following: The fresh leaves were exhausted with boiling water, the clear liquid evaporated to honey-consistence, and this extract mixed with about three times its volume of alcohol. The sediment thus obtained, consisting mainly of gum-like substance, was separated from the liquid, and the latter evaporated for driving off the alcohol. Renewed treatment of the remaining extract with cold water removed indifferent chiefly resinous substances. The clear liquid was precipitated with subacetate of lead (applied slightly in excess) and the precipitate *A* separated from the liquid *B* by filtration.

A. The precipitate was treated with diluted acetic acid and the insoluble portion (*a*) removed from the remaining solution (*b*) by means of filtering.

(*a*). The lead-compound, insoluble in acetic acid, was mixed with alcohol and decomposed by sulphuret of hydrogen. The filtered solution yielded after evaporation 1, *Eucalypto-*

tannic acid, which remains when the aqueous solution is shaken with ether, in which it dissolves only to a small extent; it is amorphous, of brownish color, of astringent taste, precipitates glue as well as tartrated antimony and chloride of iron, the latter with dark-green color; is itself precipitated from a strong solution by concentrated sulphuric acid and is not decomposed by boiling with diluted sulphuric acid. 2, *Eucalypto-gallic acid* (H. Weber's eucalyptic acid); it dissolves in 34 parts of cold water, easily in hot water as well as in alcohol and ether; it forms whitish or yellowish long rectangular prisms or needles of acid astringent taste; its solutions turn yellow with alkalies, does not precipitate glue (whereby it is separable from traces of tannic acid), yields a dark-blue solution with chloride of iron, which on addition of ammonia acquires a rich deep purple tinge, afterwards changing to claret-color, produces on careful heating *pyro-gallic acid* as a white lamellar sublimate of bitter taste and of the characteristic reactions towards nitrate of silver, lime-water, sesquichloride of iron and also sulphate of iron.

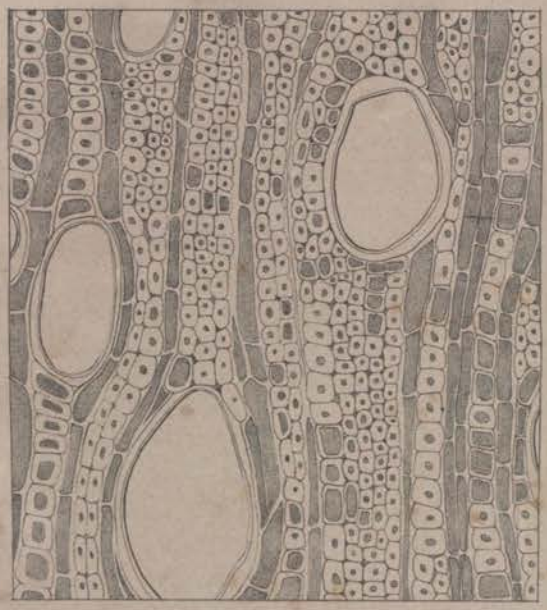
(*b*). The solution of the lead-compound in acetic acid was acted on with sulphuret of hydrogen to eliminate the lead, and the liquid filtered off and then reduced to concentration; on shaking with ether it yielded to the latter: *Eucalyptoic acid;* this is also soluble in alcohol and in water; it forms a yellowish substance, interspersed with star-like arranged hexagonal crystals and tablets, has a bitter taste, and is decomposed on boiling with diluted sulphuric acid into fruitsugar and another (as yet unexamined) substance. *Fruitsugar,* which reduces alkaline tartrate of copper, remained in the solution after the elimination of eucalyptoic acid.

B. The proportion of the aqueous extract, not precipitable by subacetate of lead, was freed by sulphuret of hydrogen from the lead. The concentrated filtered liquid, on shaking with ether, yielded to the latter: *Eucalyptin,* which is amorphous (crystallisable according to H. Weber), of brownish-yellow color, of soft consistence, without odor, of very bitter taste, of neutral reaction, soluble in about 75 parts of cold water, in less of boiling water and in still less of alcohol and ether; its aqueous solution, when boiled with diluted sulphuric acid, evolves a peculiar odor, precipitates a yellow resinous substance, and reduces alkaline tartrate of copper; it is not precipitable by tannic acid or any other reagents, indicative of alkaloids, nor sensibly affected by cold diluted acids nor by alkalies. *Fruitsugar* remained in the solution, from which the eucalyptin was withdrawn. It is left to be ascertained whether the febrifugal property, attributed to Eucalyptus-leaves, depends on the bitter glucosid, namely Eucalyptin, as seems probable, although the volatile Cajuput-like oil of the foliage possesses also undoubtedly powerful therapeutic efficacy. Gallic acid and its educt pyro-gallic acid is turned to account in photography, in dye-processes and for other requirements of technology.

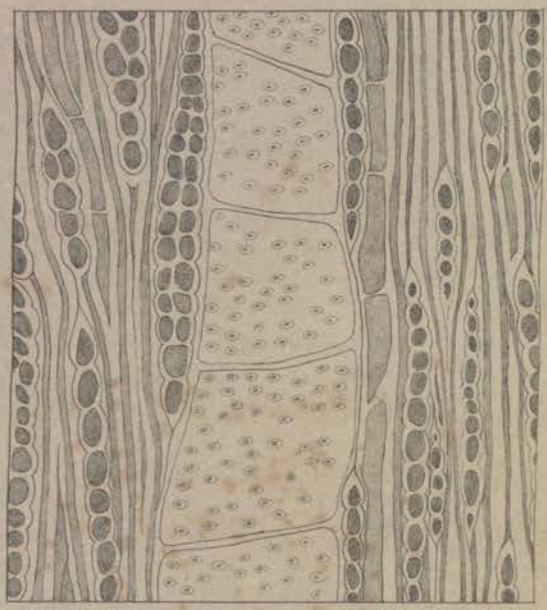
EXPLANATION OF ANALYTIC DETAILS.—1, longitudinal section of unexpanded flower; 2, side-, back- and front-view of stamens; 3, style and stigma; 4, 5 and 6, longitudinal section of fruit in its various stages; 7, transverse section of fruit; 8 and 9, sterile and fertile seeds; 10 and 11, transverse section of wood; 12 and 13, longitudinal section of wood; 1–9, moderately enlarged; 10–13, magnified 200–220 times.

ANATOMIC PLATE.—1, cellular cuticle of leaf, showing also the breathing pores; 2, transverse section of aged wood, with large openings of the vascular tubes, with rows of elongated cells, constituting the medullary rays, with parenchyma-cells scattered and more copious near the vascular tubes, and with transverse sections of closely aggregated woody fibres; 3, tangential section of aged wood with wide and dotted vascular tubes, with transversely cut cell-rows of medullary rays, with sparingly dotted woody fibres and with parenchymatous ampler interstices; 4, radial section of aged wood, with wide vascular tubes, with cell-rows of medullary rays cut vertically, with sparingly dotted woody fibres and with parenchymatous ampler interstices; all magnified 214 times diametrically.

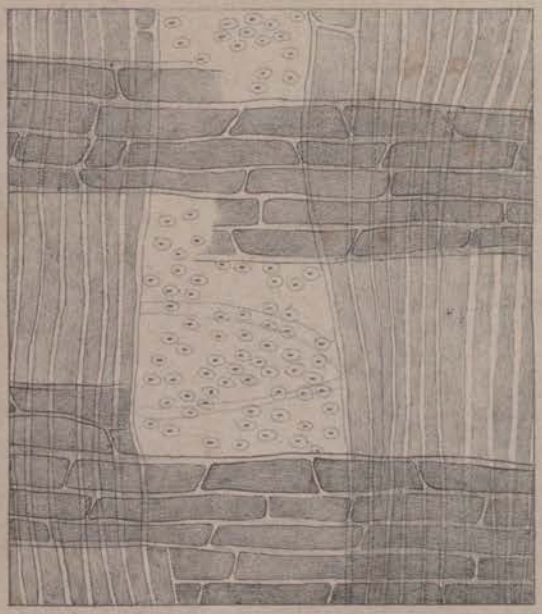
2



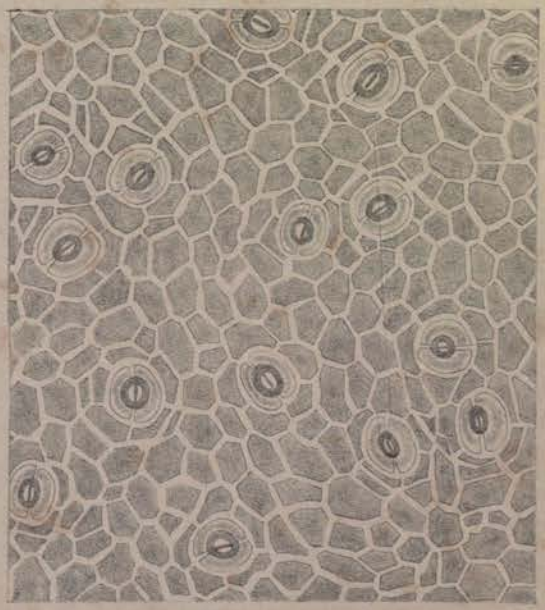
3



4



1



L. Rummel del. Baron von Mueller direxit. Steam Litho. Gov. Printing Office. Melb.

Eucalyptus rostrata. *Schlechtendal.*

Yeoll del. H.Traill & Co. Lith.

F.v.M. direxit.

Steam Litho. Gov. Printing Office Melb.

Eucalyptus siderophloia. *Bentham*

Bentham, flora Australiensis iii. 220; E. persicifolia, Candolle, prodromus systematis naturalis regni vegetabilis iii. 217, partim.

Finally tall; leaves elongate- or narrow-lanceolar, moderately or not much curved, often not very inequilateral, of almost equal color on both sides; primary *veins numerous subtle and very spreading*, the circumferential vein near to the edge of the leaf; oil-dots much concealed; umbels axillary, solitary or oftener many paniculated, with about a dozen or usually less flowers or some of the flowers only in pairs; stalks and stalklets angular, not broadly dilated; *lid from a broad-conical base attenuated into a usually narrow summit;* tube obconical-semiovate, somewhat angular, gradually attenuated into the short stalklet, shorter than the lid; stamens all fertile, *outer filaments not inflexed before expansion; anthers very minute, roundish*, opening by broadish parallel slits or apertures; stigma not or hardly broader than the style; fruit almost semiovate, tapering at the base, faintly angular; rim rather narrow in age; valves 4 or sometimes 5, inserted near the orifice, at a level with the rim or half emerging; seeds all without appendage, the sterile seeds not very narrow.

From the south-eastern districts of Queensland to the vicinity of Port Jackson.

This is the principal Ironbark-tree of New South Wales, furnishing the main-mass of timber of "Ironbark" there for the lumber-trade, four other species yielding additionally that class of wood in the sister-colony, namely E. crebra, E. melanophloia, E. paniculata and E. Leucoxylon, of all of which the latter species only extends to Victoria; but Sydney Ironbark-timber, chiefly from E. siderophloia, used to be imported into our market also, being of particular value. Maximum height of the tree, according to Mr. Ch. Moore, 150 feet; diameter of its stem to 4 feet. Bark totally persistent, deeply and somewhat anastomosingly furrowed; the furrows yellowish- or dark-brown, without cross-fibres, the ridges yielding to pressure and fissurated (Dr. Beckler). Leaves not very shining, rarely verging into an oval form, more so in young trees, turning also sometimes sickleshaped; stomata on both pages, but nearly twice as many below than above. Panicles short, axillary and terminal. Umbels not rarely compound. Stamens almost straight in bud, only slightly flexuose, thus imitating those of E. cornuta and its allies; hence the anthers not concealed before the expansion of the flower by the inflection of the filaments. Rim of the young fruit encircled inside by a flat annular membrane.

In the anthereal system of Bentham E. siderophloia belongs to the Micrantheræ; among the species of this series it is near to E. crebra, differing in broader and stiffer leaves with less isogenous stomata, thicker flowerstalks, larger flowers with a longer lid and also larger fruits, which are comparatively not so turgid. Moreover Mr. Walter Hill found on Darling's Downs the bark of E. crebra decorticating as well as persistent, a variability as yet not noticed in E. siderophloia. This tendency of the bark of E. crebra to secede at least from a portion of the branches was noticed also by the late Edw. Bowman on the Suttor-River.

E. drepanophylla, which may be perhaps a mere variety of the imperfectly known E. leptophleba, is still nearer to E. siderophloia than E. crebra; it is generally of more stunted growth; its leaves are narrower, of a paler hue, more opaque, usually also more curved and provided with stomata of almost equal number on either page; the flowerstalks are less angular and rather thinner; the lid is blunter and only of about the same length as that of the calyx-tube; the filaments show a somewhat inflected curvature while in bud; the style is shorter and bears a slightly broader stigma.

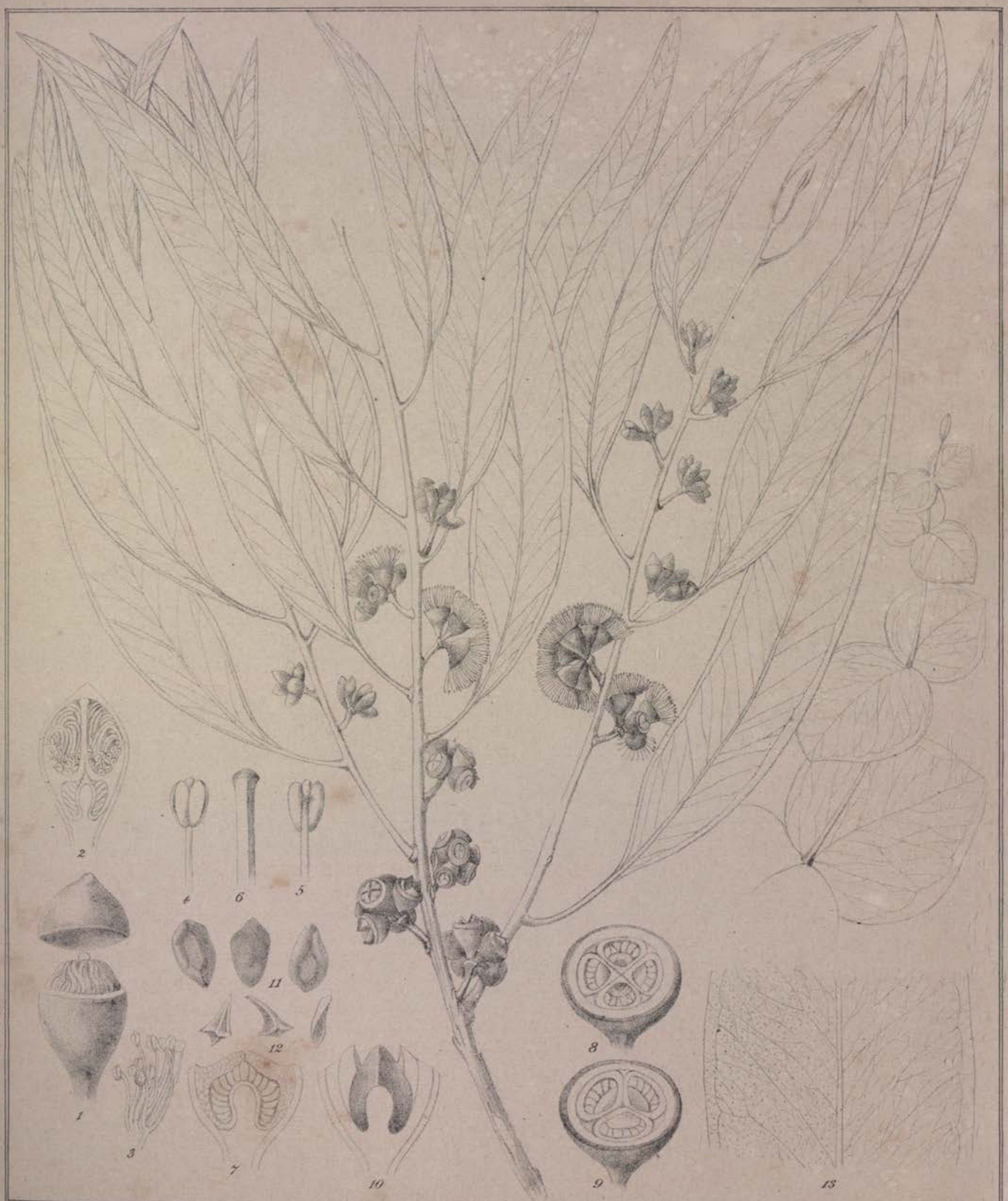
E. Bowmanii is chiefly different from E. siderophloia in less shining leaves with about equal numbers of stomata on each side, mostly solitary umbels on a broadly compressed stalk, absence of stalklets, the lid not long-pointed, the filaments while in bud more twisted and possibly also in bark and fruit. The tree from Mount Elliott, referred to by Bentham under E. Bowmanii, belongs to E. drepanophylla.

E. trachyphloia, placed by Bentham between E. siderophloia and E. crebra, is much nearer allied to E. terminalis and E. dichromophloia (as shown in the fragm. phytogr. Austr. xi. 43–44), along which species it was placed already in the Journal of the Proceedings of the Linnean Society iii. 90. E. pilularis is distinguished from E. siderophloia already by the sectional characteristic of Renantheræ.

E. fibrosa (F. v. M., in the Journal of the Linnean Society iii. 87) seems to be a variety of E. siderophloia with longer lid, which resembles that of E. tereticornis. Although it was published already in 1858, but only from specimens in flowerbud, its specific designation must give way to one so well chosen as that of E. siderophloia, especially as the bark now proves far less fibrous than that of the real Stringybark-trees.

The Rev. Dr. Woolls observes, that the Botany-Bay Kino is more extensively obtained from E. siderophloia than from E. resinifera, which (as the specific name implies) is generally regarded as the main or even sole source of that drug. Indeed Allan Cunningham and some other observers gave to E. siderophloia the name of E. resinifera. Mr. C. Moore (Reports of the Intercolonial Exhibition of 1870 at Sydney, p. 655) remarks, that the timber is of the highest reputation for strength and durability, and much used for large beams, dray-poles, railway sleepers and other purposes, where great strength is required; but its extreme hardness renders this wood difficult to work; it is light-colored and heavy; for spokes preference is here given to this over almost any other kind of wood, but the natural supply of it has become much exhausted.

Explanation of Analytic Details.—1, upper part of an unexpanded flower, the lid lifted; 2, flowerbud, showing the almost straight stamens with many of the anthers unconcealed; 3, some stamens in situ; 4 and 5, front- and back-view of an anther, with part of the filament; 6, style and stigma; 7, longitudinal section of fruit; 8 and 9, transverse sections of fruit; 10 and 11, fertile and sterile seeds; 12, a panicle of smaller fruits; 13, portion of a leaf; all magnified, but to various extent.



Todt. del. C.Troedel & Co. Lith. F.v.M. direxit. Steam. Litho. Gov. Printing Office Melb.

Eucalyptus Stuartiana. *F.v.M.*

EUCALYPTUS STUARTIANA. 59

F. v. M., in Bentham's flora Australiensis iii. 243 (partly).

The "But-But" or Apple-scented Eucalypt.

Finally tall; leaves scattered, lanceolar-sickleshaped, shining and equally dark-green on both sides, copiously dotted, but the oil-glands often partly concealed; lateral veins very thin, considerably spreading, but neither crowded nor almost transverse, the circumferential vein distinctly removed from the edge; *umbels axillary or lateral, with usually more than three flowers, on a slender stalk and with short stalklets*; *lid hemispherical, slightly pointed,* shining, not much shorter than the semiovate smooth tube of the calyx; stamens all fertile and inflexed while in bud; anthers nearly oval, opening by longitudinal slits; style very short; stigma slightly dilated; *fruit quite small, semiovate or topshaped, not angular, with deltoid exserted valves,* oftener 3- than 4-celled; rim convex, comparatively broad; seeds small, all without any appendage.

On rather sandy and moist tracts of country, occupying often low ridges, not rarely in Grasstree (Xanthorrhœa) -country, from the Barwan and Curdie's Inlet towards Cape Otway, from the middle regions adjacent to the Yarra extending to the Dandenong-Ranges and lower Gippsland, occurring also near Mudgee (Woolls), Camden and Yass (C. Moore), on the Upper Lachlan-River (Icely), at Berrima (Calvert), in the silurian formation of Adelong (Wilkinson), on the upper Clarence-River (Beckler), seemingly also extending to New England and the Condamine-River; in Tasmania near Swanport (Story).

When well developed a middle-sized tree, seldom attaining over 100 feet in height, unless occasionally on river-flats according to Mr. Howitt growing to larger size, of comparatively quick growth, the stem according to Mr. Boyle attaining a diameter of 15 inches in ten years. The main-branches are often widely spreading and less distant and more numerous than in many other Eucalypts, by which means the mass of foliage is rendered rather dense and shady; the branchlets are slender and drooping. The wrinkled brownish *bark persists* not only on the stem, but also on the primary branches; it is outside rather scaly than rugged, *inside fibrous*, whereby a position among the Pachyphloiæ (or Inophloiæ) is established for this species; but the smaller branches are smooth. Stem oftener twisted and gnarled than straight. Wood hard, but splits not well; it is used for fence-posts of fair durability where the timber of E. rostrata is unobtainable, sometimes employed for rough sorts of furniture, as it takes polish well; it affords also fair fuel. The flowers and fruits are not produced by this tree in so early a stage as those of many other species; the stalk of the umbels only slightly or not compressed and not much elongated; the stalklets sometimes almost obliterated. The lid of the calyx is generally mammillar in shape, but the apex sometimes also attenuated conically. Stamens almost white. Fruits may be seen in rare cases 5-celled. It is possible, that in this species a smooth-barked variety occurs, as would appear exceptionally to be case, according to the notes of several collectors.

A difficulty has arisen in giving a systematic designation to this species, inasmuch as in the Nederlandisk Kruidkundig Archiev iv. 131 and partly also in the flora Australiensis iii. 241–242 the name and description as well as the notes of localities apply to E. Gunnii; in the last-mentioned work even a portion of E. Stuartiana as circumscribed there belongs to E. viminalis. But as in the "Educational Collections of Australian Plants" issued in 1876 the specimens are distributed already in the limitation of the species as now here adopted, and as also in Mr. McIvor's meritorious recent work on the "Chemistry of Agriculture" E. Stuartiana in a chapter on "maintenance, creation and enrichment of forests" is defined according to the views now

promulgated here from ampler material and further field-studies, it seems better to maintain the name E. Stuartiana for the present species, than to give it a new specific appellation.

The differences, which separate E. Stuartiana from E. viminalis, are as follow : the tree is more umbrageous by virtue of its comparatively spreading and dense branches and foliage, hence in this respect more like E. Gunnii ; the bark is extensively persistent, of softer structure and more fibrous, so much so indeed as to allow this species to pass almost as a Stringybark-tree ; the leaves unlike those of E. viminalis afford no manna-like saccharine excretions, they are also of a more pleasant scent reminding slightly of the odor of apples, while their veins are not quite so spreading and the oil-dots generally more copious and transparent ; the stem of the seedlings is more quadrangular, their leaves are roundish or broad-ovate or even cordate, faintly tinged with whitish bloom, not very narrow nor bright-green as in E. viminalis, though at first likewise opposite and sessile ; the wood is darker, when dry and aged very much so, as observed by Mr. Boyle, who confirms also most of the other characteristics here given, and states that this Eucalypt is often accompanied by a stunted state of E. obliqua, but keeps away from any richer adjoining ground of alluvial valleys, studded over by E. Gunnii and E. viminalis, contrasting with both species at the first glance in its bark ; the foliage is of a more saturated and more shining green, the lateral veins of the leaves are rather more distant, not quite so spreading and hardly so distinctly visible ; the flowers in each umbel are as a rule 5–8, although sometimes they may also be reduced to 3 and very exceptionally even to 2 or 1 ; the lid of the calyx is usually shorter, if even only slightly so ; the fruits are prevailingly 3-celled, not as in E. viminalis predominently 4-celled and often somewhat smaller.

The disparities, by which E. Stuartiana (as here adopted) can be distinguished from E. Gunnii, the real Swamp-Gum-tree, consist in its bark never decorticating to a perfect smoothness unless on the branches and upper part of the stem, in generally longer much narrower more curved and not almost equilateral leaves mostly of thinner consistence, with less prominent veins and more numerous pellucid oil-pores, in often smaller fruits with more protruding rim and valves, in which latter respects as well as in its leaves E. Stuartiana approaches more closely to E. viminalis than to E. Gunnii. It moreover reaches never any very high mountain-elevations, whereas the latter ascends actually up to alpine regions.

The variety longifolia of E. Stuartiana, recorded by Bentham, belongs to E. punctata (Cand. Prodr. iii. 217 ; mem. des Myrtacées t. 4) the "Leather-Jacket" of the colonists of New South Wales, which differs specifically in more solid and smoother bark, stouter very angular branchlets, leaves opaque and paler beneath, the lateral veins more spreading and finer still, the peripheric vein almost contiguous to the edge, nearly obliterated oil-dots, at least partially paniculated flowers, stronger more compressed and often longer flowerstalks, also usually thicker and more elongated stalklets, the lids longer and more gradually pointed, the stamens more elongated with seemingly darker filaments, the border of the ripe fruit less convex or even flat.

E. Stuartiana bears the name of an assiduous collector of Tasmanian plants, who subsequently also largely contributed to our knowledge of the vegetation of New England through museum-material. The aboriginal appellation "But-But" arose with the natives of Gippsland according to information from Mr. W. Howitt.

EXPLANATION OF ANALYTIC DETAILS.—1, an unexpanded flower, the lid lifted ; 2, longitudinal section of an unexpanded flower ; 3, some stamens in situ ; 4 and 5, front- and back-view of anther with portion of filament ; 6, stigma and portion of style ; 7, longitudinal section of young fruit ; 8 and 9, transverse section of fruit ; 10, longitudinal section of fruit ; 11 and 12, fertile and sterile seeds ; 13, portion of a leaf ; all magnified, but to various extent.

Todt. del. & Tregear & Co. Lith.

F. v. M. direxit

Steam Lithic. Gov. Printing Office Melb.

Eucalyptus uncinata. *Turczaninow.*

Turczaninow, in Bulletin de la Société des Naturalistes à Moscou 1849, ii. 23 ; Bentham, flora Australiensis iii. 216 ; E. leptophylla, Miquel, in Nederlandisk Kruidkundig Archief iv. 123.

Shrubby ; *leaves* scattered, on short stalks, usually *narrow-lanceolar, copiously dark-dotted,* of equal green on both sides, never much elongated, their lateral veins exceedingly fine, rather close and considerably spreading, nowhere prominent, the circumferential vein very close to the edge of the leaf or almost contiguous with it ; umbels axillary and solitary or occasionally some arranged into terminal racemous short panicles ; flowerstalks rather short, not or slightly compressed or seldom sharply biangular, each with 3 to 9 flowers ; tube of the calyx almost semiovate, provided with a very short or no stalklet, not or sometimes faintly angular ; lid quite semiovate or occasionally upwards narrow-conically attenuated, from nearly twice as long as the calyx-tube to hardly equalling the latter in length ; stamens all fertile ; *filaments suddenly and sharply infracted before expansion but not flexuous ; anthers very minute, almost globular, opening towards the summit with lateral pores ;* style of bristly thinness ; stigma exceedingly minute ; fruits small, semiovate, mostly 3- or less frequently 4-celled, the rim broadish and flat or internally descending, the valves inserted not much beneath the orifice, quite enclosed or with their pointed summits slightly exserted ; seeds minute without any appendage.

In the sandy or calcareous desert-country from the Murray-River and its lower tributaries to the west coast, there known to extend northward at least as far as the Murchison-River.

This species constitutes a considerable portion of the "Mallee-Scrub," chiefly along with E. oleosa and E. gracilis. It always remains of shrubby growth, with several thin stems branched from near the base. The bark is smooth and greyish or may assume a reddish tint, gradually peeling off in fragments of layers, preventing it becoming rough and furrowed by age. Branches erect, never drooping. Leaves of firm consistence, of very light green, somewhat shining, occasionally broad-lanceolar, sometimes lanceolate-linear, generally terminated (as in many other Eucalypts) by a short narrow hooked apex, from which the specific name in this instance is derived. Their oil-dots not translucent or only exceptionally so. The leafstalks sometimes almost absent. Bentham noted opposite leaves in young plants ; I find them in rare instances so even on fruitbearing branches, and I have also from Lake Muir specimens, seemingly of E. uncinata, in which the leaves become broader than long and perfectly connate into pairs, the leafy mass of each pair surrounding undivided the branches (as in the upper leaves of the British honeysuckle). Umbels in age lateral. Lid sometimes assuming a red hue. The filaments, though thin-capillary, appear somewhat rigid through being not flexuous in bud, their straightness (except the single infraction) giving to the mass of stamens when viewed as a whole an almost silky lustre. Anthers with no glandular turgidity, occasionally somewhat truncated or approaching an obcordate form. Style extended beyond the stamens in bud. The valves of the fruit may occur sometimes more elongated and fine-pointed from the persistent basal remnants of the style. The sterile seeds are partly narrow, but all very short ; the fertile seeds are almost oval and rather plan-convex.

E. uncinata is easily recognized by its very fine filaments not being flexuous, but remaining mostly bent inward about their middle at nearly right angles, even when already expanded ; in this respect E. corynocalyx and E. decurva approach it, as mentioned by Bentham, but the former differs in its finally tall stature, broader not dark-dotted leaves, longer stalklets of the flowers, proportionately short lid, elongated anthers opening by slits, thicker style, longer also streaked and at the orifice more contracted fruits with narrower rim and deeper enclosed valves ; indeed it

belongs to the section Parallelantheræ, not Micrantheræ. The differences of E. micranthera are less obvious, consisting in somewhat larger undotted leaves with the circumferential vein distant from the edge, lid shorter than the tube of the calyx, which latter is also proportionately broader, in thicker filaments, the openings of the anthers extending further downward, stout style and somewhat larger fruit; the filaments are in a similar way very straight except the single curvature about their middle. E. decurva attains a greater height, has the leaves longer stalked, darker green and not conspicuously dotted, nor the circumferential vein so near to the margin of the leaf, but the closely reticular veinlets very visible, longer more slender and mostly decurved flower-stalks, the lid much shorter than the tube of the calyx, the filaments not so fine, anthers evidently longer than broad opening by longitudinal fissures, the fruits more contracted at the mouth and the valves deeper sunk.

In regard to technical importance of E. uncinata it may be mentioned, that the volatile Mallee-oil, usually ascribed to E. oleosa, is in all probability partly derived from E. uncinata.

Explanation of Analytic Details.—1, an unexpanded flower, the lid lifted; 2, longitudinal section of an unexpanded flower; 3, some stamens in situ; 4, 5 and 6, back-, front- and side-view of an anther with portion of its filament; 7, style with stigma; 8 and 9, transverse and longitudinal section of fruit; 10 and 11, sterile and fertile seeds; 12, portion of a leaf; all magnified but to various extent.

EUCALYPTOGRAPHIA.

A DESCRIPTIVE ATLAS

OF THE

EUCALYPTS OF AUSTRALIA

AND THE

ADJOINING ISLANDS;

BY

BARON FERD. VON MUELLER, K.C.M.G., M. & PH.D., F.R.S.,

GOVERNMENT BOTANIST FOR THE COLONY OF VICTORIA.

"NON SUCCIDES ARBORIS, NEC SECURIBUS DEBES VASTARE EARUM REGIONEM."—*Liber Deuteronomii* XX. 19.

FIFTH DECADE.

MELBOURNE:

JOHN FERRES, GOVERNMENT PRINTER.

PUBLISHED ALSO BY GEORGE ROBERTSON, LITTLE COLLINS STREET.

LONDON:

TRÜBNER AND CO., 57 AND 59 LUDGATE HILL; AND GEORGE ROBERTSON, 17 WARWICK SQUARE.

M DCCC LXXX.

Th.dit del. C.Troedel & Cº Lith. F.v.M. direxit. Steam Litho. Gov. Printing Office Melb.

Eucalyptus amygdalina. *Labillardière.*

Labillardière, Novæ Hollandiæ plantarum specimen ii. 14, t. 154 (1806); Candolle, prodromus systematis naturalis regni vegetabilis iii. 219; Hooker, Botanical Magazine t. 3260; J. Hooker, flora Tasmanica, i. 35; F. v. M., fragmenta phytographiæ Australiæ ii. 53; Bentham, flora Australiensis iii. 202; E. radiata, Sieber, in Candolle prodromus systematis naturalis regni vegetabilis iii. 218; Candolle, mémoire sur la famille des myrtacées, t. 7; J. Hooker, flora Tasmanica i. 137; E. elata, Dehnhardt, catalogus plantarum horti Camaldulensis p. 26 (1829); E. tenuiramis, Miquel, in Nederlandisk Kruidkundig Archief iv. 128; E. nitida, J. Hooker, flora Tasmanica, i. 137, t. xxix.

The "Giant-Eucalypt" or "Wangara." Finally very tall; branchlets slender; leaves on rather short stalks, scattered or rarely opposite, narrow- or sickleshaped-lanceolar or very narrow, usually attenuated into an acute but oblique base, generally not of thick consistence, mostly of a saturated green and somewhat shining on both sides; *lateral veins very thin, not much spreading*, nor closely approximated, the circumferential vein remote from the edge of the leaf; *oil-dots very copious, transparent;* umbels with few or oftener several or many flowers, solitary, axillary, on slender almost cylindrical or slightly angular sometimes very short stalks; calyces small, attenuated into a short thin stalklet, not angular; tube obconical, upwards dilated, usually twice as long as the hemispheric blunt or short-pointed lid; stamens very short, all fertile, inflexed before expansion; *anthers very small, nearly kidneyshaped*, opening with divergent slits; stigma hardly broader than the style; ripe fruits small, semiovate or sometimes verging towards a truncate-globular form, 3- to 4- or rarely 5-celled, the rim finally flat and usually rather broad; valves tender, convergent, deltoid, close to the orifice, slightly or not exserted; fertile as well as sterile seeds quite small, all without appendage.

From the southern and the whole eastern humid districts of the colony of Victoria extending to the base of the Alps, to the Blue Mountains and the litoral slopes of New South Wales, not far advancing on the western fall of the country, frequent in Tasmania, ascending to about 4,000 feet elevation.

This Eucalyptus is one of the most remarkable and important of all plants in the whole creation! Viewed in its marvellous height when standing forth in its fullest development on the slopes or within glens of mountain-forests, it represents probably the *tallest of all trees of the globe;* considered as a hardwood-tree of celerity in growth it ranks among the very foremost; regarded in reference to its timber the tall variety can fairly be classed with the superior kinds of Eucalypts, and contemplated in respect to the yield of volatile oil from its copious foliage it is unsurpassed and perhaps not equalled by any other tree in the whole world! These various signal qualities of E. amygdalina having become gradually known, much through the exertions of the writer, this tree has found already a wide appreciation abroad, in countries neither subject to severe frosts nor to intense moist heat. It assumes under different climatic and geologic conditions various forms; thus in the irrigated ravines of cooler ranges the tree attains the most towering height, combined with a perfect straightness of stem, while the outer layers of its bark decorticate so completely as to render the huge stems quite smooth and almost white, the habit then being that of its only rival in loftiness among congeners, namely E. diversicolor (the Karri of West Australia). This lofty state of the tree passes as one of the White Gum-trees (and even also as Mountain-Ash in the Dandenong-Ranges), while phytographically it has been distinguished as "regnans." According to Mr. F. Abbott it is this form, which constitutes the "Swamp Gum-tree" in Tasmania, where already Sir William Denison placed early its huge dimensions on record. In more open and in merely ridgy country E. amygdalina remains much lower in stature, even

often a comparatively dwarf tree, with outside rough, inside tough somewhat fibrous bark, which remains more or less persistent on the stem and even lower branches ; under such conditions the species is called a " Peppermint-tree " in Victoria and Tasmania and a " Messmate-tree " in some tracts of New South Wales. (*Vide* Woolls, Lectures on the Vegetable Kingdom, p. 121.)

The bark, when it persists, is however much more solid than that of E. macrorrhyncha and E. obliqua, offering a transit of the Pachyphloiæ to Rhytiphloiæ. On account of the toughness of the inner bark the natives of Gippsland have given to this tree the name of " Wangara," meaning literally translated " Bark strong " (Howitt). The stems of young seedlings or of sprouts from stumps are thin, somewhat warty- or glandular-rough, not angular ; their leaves are opposite, sessile, narrow oblong- or oval-lanceolar, rounded or cordate at the base or even connate as in E. uncinata, paler beneath and sometimes covered with whitish bloom. The leaves of the aged tree from cold exposed localities are thicker (as is the case also with E. Gunnii), and then the oil-glands are much obscured. Flowering and fruiting branches present only under exceptional circumstances opposite leaves. As many as 43 flowers have been counted by me in one umbel. Instances occur, in which the lid is acutely pointed. The fruit is occasionally shortened to an almost hemispheric form and its valves may occur increased even to six ; the rim sometimes descends rather abruptly to the valves, rendering then the edge of the orifice narrow.

The systematic name, given by Mons. Labillardière to this tree, is not happily chosen, as it neither in habit nor in foliage nor in any other way bears resemblance to the Almond-tree. His work illustrates the narrow-leaved variety. To the synonyms are added by Bentham E. longifolia (Lindley, Botanical Register 947) and hence E. Lindleyana (Candolle, prodromus iii. 219), although the drawing affords no positive evidence of the species intended. Bentham refers here doubtfully also E. ambigua (Candolle, prodromus iii. 219), which however may be a West Australian species, the somewhat leathery leaves, the compressed flowerstalks and the almost globular fruit not really pointing to E. amygdalina ; but E. linearis (Dehnhardt, Rivista Napolitana i. 3, p. 173 anno 1839) seems merely to indicate a variety, remarkable for the extraordinary narrowness of its leaves, but neither flowers nor fruits occur in the authentic specimen, preserved in the collection of Baron Cesati, who kindly placed samples of Dehnhardt's original plants at my disposal.

Eucalyptus Risdoni (J. Hooker, in the London Journal of Botany vi. 477 ; flora Tasmanica i. 133, t. 24 ; Bentham, flora Australiensis iii. 203) seems an aberrant form only of E. amygdalina, as pointed out by me already in 1860 ; and the same may be said of E. dives (Schauer, in Walpers repertorium botanices sytematicæ ii. 926 ; Bentham, flora Australiensis iii. 205) ; but the local circumstances, under which these seemingly aberrative states arose, remain hitherto uninvestigated. E. Risdoni is as yet only known from Southern Tasmania ; it is a small tree ; the leaves of the upper branches are mostly, like those of the variety nitida (E. nitida, J. Hooker), thick and rigid, comparatively short and almost equilateral, while the leaves of the lower branches are, like those of seedlings and sprouts, opposite, sessile, broad, often connate and as well as the branchlets and umbels chalky-whitish, moreover the fruits are generally larger ; but these characteristics are of degree only and none positively specific ; it would seem also as if analogous cases were presented by E. Stuartiana and E. crebra, inasmuch as E. cinerea and E. melanophloia appear to hold the same position to E. Stuartiana and E. crebra as E. Risdoni to E. amygdalina. The distinctions of E. dives are equally weak, being reduced to the suppression or extreme shortness of the leafstalks, and to opposite thick ovate- or broad-lanceolar leaves, but it is wanting altogether in the chalky

but also variable coloration of E. Risdoni ; it is now also known from the sources of the Loddon and Shoalhaven-River. The unreliability of the cortical characteristics of E. amygdalina render it sometimes difficult to distinguish this species from E. Sieberiana, especially in the absence of flowers ; but that portion of the bark, which long persists, is not deeply furrowed, the wood is more fissile, the leaves are more copiously dotted, the flowerstalks are not strongly compressed, none of the stamens are sterile, and the fruit is less elongated. It differs from E. hæmastoma in the veins of the leaves less spreading and less prominent, in thinner almost cylindric flowerstalks and all the filaments provided with anthers, also in comparatively shorter fruit. The thick-leaved varieties of E. amygdalina approach in many respects E. coccifera, but the lid of the calyx is not remarkably depressed even in the Risdonian variety, with which this shares the chalky bloom, the tube of the calyx of the genuine E. amygdalina is never so long and not angular, the flowerstalks are not so stout nor so flattened and the stalklets more slender. That form of E. amygdalina, which produces fruits more contracted at the orifice, bears so far much resemblance to E. piperita, but the bark is less persistent and less stringy, the veins of the leaves are not so spreading, the lid is never conical, the stalklets are generally longer and the fruits as a rule smaller. All the other species of the section Renantheræ are more distinct.

The number and distribution of the stomata are in this species subject to unusual variability, explainable by the age of the tree and the open or shady position of its growth.

This tree has a preference for the silurian formation and particularly for metamorphic schist, as first traced by Mr. Howitt, at least in our uplands.

E. amygdalina is one of the hardier of its congeners, and if E. coccifera constitutes an alpine state of it, then it has in that remarkable form braved even unusually cold winters of Britain. For instance at Powderham-Castle, the seat of the Earl of Devon, it passed unscathed through an ordeal of + 9° of Fahrenheit's scale while E. globulus was destroyed already at + 20° F. The above noted severe cold caused to E. coccifera no injury whatever, so that perhaps that tree will withstand a still somewhat lower temperature ; it produced in the subsequent summer thousands of sprays of blossoms. Its height at Powderham-Castle was 58 feet, the stem measuring at $3\frac{1}{2}$ feet from the ground $7\frac{1}{2}$ feet in circumference ; it grows there on sandy loam of rising ground. (Powell, in the Gardener's Chronicle 1879, p. 113, with xylographic illustration.)

It is the intention to give on a future occasion a schedule of exact measurements, clinometrically obtained, of the tallest individual trees anywhere to be found ; but it may for the present suffice to observe, that approximate heights for this tree of 400 feet have been obtained by the writer at the Black Spur and elsewhere on the Upper Yarra and Upper Goulburn-River. Mr. D. Boyle first of all ascertained the length of a fallen tree of this species, found by him in the Dandenong-Ranges, at 420 feet ; the length of the stem up to the first branch being 295 feet, the diameter of the stem at the commencement of the ramification proved 4 feet, 70 feet higher up the diameter was still 3 feet, the top-portion was wanting. A still thicker tree there measured at 3 feet from the ground 53 feet in circumference. Mr. Boyle found another tree with a stem 25 feet in diameter at the base, yet the bark quite thin. Mr. Howitt obtained in Gippsland also measurements up to 410 feet. The Rev. Th. Ewing (as stated in Henfrey's Botanic Gazette) measured a prostrate tree on a rill of the North-West Bay River at the rear of Mount Wellington already thirty years ago and recorded the height up to the first branch 220 feet, from thence to where the top was broken off 64 feet more ; the basal diameter proved to be 30 feet, the stem-diameter at 220 feet was still 12 feet ! and to that distance it would turn out already more timber than three

of the largest oaks taken together with their branches. A standing tree at the same place measured 3 feet from the ground 102 feet in circumference, but close to the ground even 130 feet! The rev. gentleman observed within a square mile at least 100 trees, none less than 40 feet in circumference at the base (Dr. Masters). Mr. G. Robinson noticed in the back-ranges of Berwick the circumference of a stem to be even 81 feet at a distance of 4 feet from the ground. (*See* Ellwood Cooper's edition of some of my lectures and essays, p. 161). The same gentleman, whose professional judgment as a surveyor would give every guarantee for accuracy, obtained at the foot of Mount Baw Baw the measurement of an exceptionally large tree, which was 471 feet high. From the Cape Otway-Ranges a tree is also on record by Mr. Walter, with a height of 415 feet and a basal diameter of 15 feet, although the loftiest trees have not always the most colossal stems. But though this Eucalypt of ours will probably maintain the actual supremacy in height among trees of the globe, it must cede the palm of superiority perhaps to the Wellingtonia-Sequoia and the only other congener of the Mammoth-tree of California in respect to height combined with massive ramification and a crown of foliage dense to the summit in Sequoias—because the final extraordinary height of E. amygdalina is often attained only by a solitary straggling branch, pushing singly towards the sky. It is a grand picture to see a mass of enormously tall trees of this kind with stems of mast-like straightness and clear whiteness so close together in the forest as to allow them space only towards their summit to send their scanty branches and sparse foliage to the free light.

The timber is useful for many kinds of carpenters' work; in drying it does not twist; when straight stems are produced in forest-valleys the wood splits better into palings than even that of our Stringybark-tree, and this with such facility, that in some particular instance a laborer has split 620 palings of 5 feet length in one day; the timber is comparatively not heavy, as it floats in water, unlike that of many other Eucalypts; it is particularly well adapted for shingles, palings and rails and also drawn into use for shipbuilding, especially kelsons and planking (*see* F. v. M., Select Plants, Indian edition p. 107), but it has not been found very lasting underground and does not afford a superior fuel; indeed the stems, when fallen, perish more quickly than those of many other Eucalypts, and thus the records of individual trees of marvellous height, when measured lying on the ground, are often early lost.

The utmost praise is due to Joseph Bosisto, Esq., M.L.A., J.P., for his lengthened and extensive researches on the oil of this and other congeners, to the technical production, local utilisation and mercantile export of which he has given large dimensions by his enterprise and perseverance, it having fallen to the writer's share to draw in first instance attention to the enormous yield of oil from the foliage of E. amygdalina. Mr. Bosisto sums up his experience with the Eucalyptus-oils, as regards the percentage of the yield of the various species, on which he experimented, in the followinu schedule :—

From 1,000 lbs. of fresh leaves with their stalklets and branchlets—

Eucalyptus viminalis yields	... ...	7 ounces	
melliodora yields	... ...	7 „	
rostrata yields	... ...	15 „	
obliqua yields	... ...	80 „	
globulus yields	... ...	120 „.	
Eucalyptus goniocalyx yields	... ...	150 ounces	
Leucoxylon yields	... ...	160 „	
oleosa (mixed with other species of the Mallee-scrub) yields	...	200 „	
amygdalina yields	... ...	500 „	

But this average-yield, thus demonstrated by Mr. Bosisto to rise to more than 3 per cent. in E. amygdalina, fluctuates during the various seasons, it being during the cool months of the year

appreciably less than during the summer. The distilled oil from the foliage of E. amygdalina is pale-yellow, thin, of rather pungent Cajuput-like odor, of cooling afterwards bitter taste, of 0·881 specific gravity, boils at from 329 to 370° F., deposits stearopten at low temperatures. Mr. J. W. Osborne, who at the instance of the author subjected various Eucalyptus-oils to extensive tests for the second London Exhibition, found the diminishing degree of solubility of the following substances to be in the subsequent order: Camphor, Pine-resins, Mastic, Sandarac, Elemi, Kauri, Asphalt, Xanthorrhœa-resin, Benzoe, Copal, Amber, Anime, Shellac, Caoutchouc, Beeswax. (*See* Jurors' Report of the Exhibition of 1863.) Eucalyptus-oil dissolves also Gutta-Percha readily, and can be used in lamps like Petroleum, with this important advantage, that it has greater illuminating power, has a rather pleasant odor and is not liable to cause explosions, though it remains a much more costly article. Eucalyptus-leaves found however during the earlier period of our colony for years use in one of our towns for the production of light-gas. Mr. Bosisto obtained 10 per cent. of pearlash from the ashes of the foliage of E. amygdalina.

Eucalyptol, first obtained by Cloëz in Paris, through repeated fractional distillation, presents according to him the chemical formula C^{24} H^{20} O^2; it is a very mobile colorless liquid, boiling at 347° F., of 0·905 specific gravity. It rotates polarized light to the right, remains liquid at low temperatures, is little soluble in water, completely in alcohol, the solution being of somewhat rosy odor when much diluted; Eucalyptol forms when distilled with anhydrous phosphoric acid Eucalypten = C^{24} H^{18}, a liquid boiling at 329° F. and of 0·836 specific gravity. (Compt. Rend. lxx. 678.) But Eucalyptol, according to Drs. Homeyer and A. Faust, is composed of a terpene and cymene (both hydrocarbons) and eucalyptol; the proportions of these in various Eucalyptus-oils is not the same.

The capacity of the stills in Mr. Bosisto's factory in Western Gippsland amounts at present approximately to 2,000 gallons, the produce of oil being about 12,000 lbs. annually now; as much as 6 tons of leaves are operated on daily. These extensive operations have reduced the product to a remarkable cheapness, so much so that the wholesale-price in Victoria has sunk to 2s. 6d. per lb., while in the English market it is only 3s. Eucalyptus-oil, irrespective of its great therapeutic value, is much used for additions to perfumery (dilution of the oils of roses, orange-flowers &c.) and for select varnishes and various other technic applications. Several other species yield volatile oil also very copiously, for instance E. salubris, E. salmonophloia, E. longicornis, E. microcorys (*see* F. v. M., Report on the Forest-Resources of Western Australia, pp. 12–15, pl. xii., xiii., xiv.), but most of them being smaller trees, would not afford an equal bulk of foliage. When the stems of the dwarf variety are cut, new shoots spring from the root, thus a fresh crop of foliage is furnished in a few years. Sir William Denison, G.C.M.G., Sir Robert Officer and Dr. Motherwell instituted in Tasmania about thirty years ago some experiments for the distillation of Eucalyptus-oil; but these observations were not followed up there by any practical applications in factories; but in that island pyrolignous acid was produced from Eucalyptus wood on a large scale for some years, but this operation was discontinued, perhaps because the other products of dry distillation such as tar, pitch and wood-alcohol could not be sufficiently utilized at the time.

The hygienic properties of Eucalypts, largely dependent on the volatile oil of their foliage, have been discussed in many essays, one on this subject by our fellow-colonist Mr. Bosisto being among the foremost. (*See* Proceedings of the Royal Society of Victoria, August 1874).

Mons. P. Ramel, Mons. A. Thozet, the writer and many others have early drawn public attention to the importance of these trees for subduing malaria, after incidentally the febrifugal properties of the Eucalypts had been discovered first by Spanish physicians in 1866 and been confirmed soon subsequently by medical men in France and Italy, to whom the opportunities for hygienic researches of this kind much more readily arose than to us here, in places where periodically or even continuously malarian fevers were raging, and where these, so soon as Eucalyptus-vegetation copiously arose (and this often through the instrumentality of the writer) the disease was suddenly or gradually checked, mostly even without recurrence. The powerful disinfecting action of the oily volatile emanations of the Eucalypts are mainly due to the evolution of Ozone and double oxyd of Hydrogen, as shown by experiments of Dr. Andrews and Dr. G. Day. But irrespective of this the power of also this Eucalypt to absorb moisture from the ground is enormous and of vast hygienic significance, and stands in proportion to the intensity of the aqueous exhalation, in which latter respect many Eucalypts vastly surpass Elms, Oaks, Poplars and many other trees. (*See* my lecture on "Forest-culture in relation to Industrial Pursuits" &c., Ellwood Cooper's edition p. 99.) The gradually dropping foliage, unlike that of most other trees, acts also deodorizing on the soil. Sir Will. Macarthur alluded likewise early to the healthiness of Eucalyptus-regions.

Again quite recently Prince Pierre Troubetzkoy once more insisted, as was done by us here many years ago, that to E. amygdalina preference should be given over any other congener for plantations in any paludal fever-regions, wherever climatic circumstances would allow it to prosper, although this species grows not with quite the rapidity of E. globulus, nor accommodates itself with the same facility to a great diversity of soils. At Lago Maggiore, where Prince Troubetzkoy instituted his observations, E. amygdalina grew 60 feet in nine years, and endured a temperature sinking occasionally as low as 18° F., proving hardier than E. globulus and E. rostrata. *See* Bulletin de la Société d'Acclimatation, Paris, 1879, pp. 338–342, in which important journal the culture of Eucalyptus has been strenuously advocated by M. Ramel and numerous other writers ever since 1858. *See* also Count Luigi Torelli's Memoir "l'Eucalyptus e Roma" 1879, pp. 48–49.

Dr. Josef Moeller of Vienna describes the wood of E. amygdalina anatomically in nearly the following words (translated) :—The vascular tubes are always isolated and irregularly scattered in scanty number; their lumen exceeds rarely 0·06 mm.; their walls are but slightly thickened and are seriated-dotted; parenchyma is only scantily developed; the woody fibres are also dotted, at an average 0·012 mm. broad, of which two-thirds pertain to the lumen; their contours are uneven; the medullary rays consist of one or two rows of cells, not rarely cubical and rather broad about 0·024 mm.

The form of the expanded cotyledonar leaves is characteristic to some extent for various Eucalypts; in E. amygdalina they are ovate-kidneyshaped and tapering into short stalklets, whereas some other species, for instance E. cornuta, have them deeply cleft into two narrow divergent lobes.

Explanation of Analytic Details.—1, unexpanded flower, the lid partly lifted; 2, longitudinal section of an unexpanded flower; 3, some stamens in situ; 4–5, back- and front-view of a stamen with part of its filament; 6, style and stigma; 7 and 8, transverse and longitudinal section of fruits; 9 and 10, fertile and sterile seeds; 11, portion of a leaf; 12, vascular, prosenchymatous and parenchymatous elements of wood; all magnified to various extent, fig. 12 as much as 220 times diametrically.

R. Austen del. C. Troedel & Co. Lith.

F. v. M. direxit.

Steam Litho. Gov. Printing Office Melb.

Eucalyptus Corymbosa. *Smith.*

Smith, a specimen of the Botany of New Holland 43 (1793); Transactions of the Linnean Society iii. 287; Cavanilles, icones et descriptiones plantarum t. 340; De Candolle, prodromus systematis naturalis regni vegetabilis iii. 220; F. v. M., fragmenta phytographiæ Australiæ ii. 46; Bentham, flora Australiensis iii. 256; Metrosideros gummifera, Solander, in Gærtner de fructibus et seminibus i. 170, tab. 34, fig. 1.

The ordinary Bloodwood-tree.

Finally tall; *leaves* scattered, of firm consistence, ovate- or elongate-lanceolar, slightly curved or somewhat sickleshaped, *paler beneath, the lateral veins very numerous, subtle, almost transversely spreading*, the circumferential vein nearly contiguous to the edge; the oil-dots generally concealed or obliterated; *umbels paniculated*, mostly terminal, rarely solitary and axillary, on slender slightly compressed or angular stalks, bearing from 3 to 9 rather large flowers; stalklets from somewhat shorter to considerably longer than the calyx, angular, rather slender; *lid depressed-hemispherical*, short-pointed, *tearing off along a rather irregular transverse line*, exceeded in width and much in length by the obconic-bellshaped tube of the calyx; stamens all fertile, inflexed before expansion; filaments yellowish-white; anthers oblong-oval, blunt, opening by longitudinal parallel slits; ovary flat-topped; stigma hardly broader than the summit of the style; *fruit large, oval-urnshaped*, not angular, 3- or oftener 4-celled; rim narrow; *valves deeply enclosed, deltoid; fertile seeds large, procided with a narrow or short appendicular membrane*, sterile seeds much smaller.

From the vicinity of the Genoa-River to near Rockingham-Bay on dry ridges and hills or in open forest-ground, ascending to considerable mountain-elevations in New England.

A tree, attaining a maximum-height of 150 feet, but often of much lower and sometimes stunted growth, fruiting already when hardly advanced beyond its early shrubby state. *Bark persistent, outside rough*, wrinkled, grey and turning somewhat black, inside yellowish- or reddish-brown; that of the upper branches smooth and often reddish; but in New England it seems to be noticed, that the bark also becomes smooth and whitish from shelving off in flakes. Branchlets not very angular. Panicles more or less ample, of pleasant scent. Calyces generally dark-colored; the rim of their tube soon after flowering somewhat revolute. Lid not dehiscent along a sharply defined suture, often continuing to adhere to the rim unilaterally for some time. Filaments not so fine-capillary as in many other species. Anthers dorsifixed. Fruits not generally polished-smooth, but of a dull color outside; the valves sometimes remaining coherent and then seceding as a circular disk. Seeds rather few in each cell.

The wood is easily enough worked when fresh, but becomes very hard when dry; it is long-lasting underground and according to Mr. S. Johnson it is as resistent to the Termites as the wood of several Ironbark-trees, but it is intersected by concentric fissures, filled with fluid or indurated Kino-secretions, whence the popular name of this tree is derived; but for the same reason the timber is not available for sawing purposes, and it does not turn out a good fuel, as it is difficult to burn. The Kino-sap indurates soon on its own accord, as in all congeners, and is gathered for therapeutic or industrial purposes as exuded spontaneously from the stem and bark, in its dry state without any preparation, liquid Kino becoming merely exceptionally mercantile and then also only as a crude product. This seems not generally known abroad, nor the fact, that the mere general name "Gum-tree" for Eucalypts does not indicate even the least supply of Kino for commercial purposes. (*See* Wiesner, die Rohstoffe des Pflanzenreiches p. 188.)

The species, as far as here noticed, is restricted to the ordinary state, in which it appears through the more litoral regions of New South Wales and Southern Queensland. But the greatest

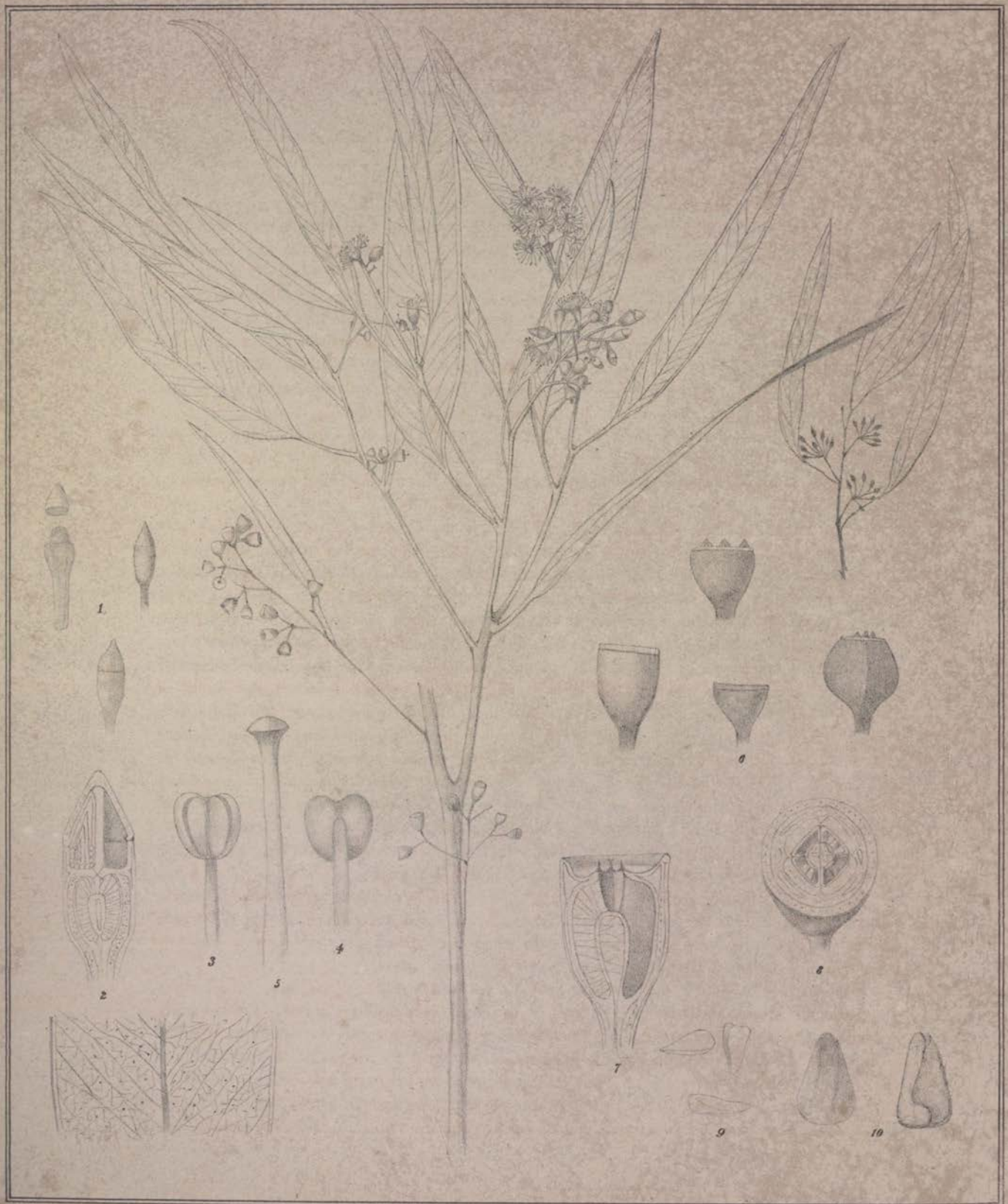
embarrassment has arisen in specifying the limits, by which E. terminalis (E. pyrophora, Bentham, flora Australiensis iii. 257) may constantly be separated; thus Bentham already was inclined to consider both as forms only of E. corymbosa, a view which the accumulation of much additional material has almost confirmed. In the wide tracts of intratropical Australia E. terminalis with its varieties occurs even far inland, thus at the Barcoo (Dr. Wuth) and at Lady Charlotte's Water (E. Giles) in such hot and arid regions, as are climatically vastly different from the cool forest-ravines of the south-east coast; hence gradually the leaves become paler, nearly or fully as much on the upper surface as beneath, their position gets more vertical and therewith stomata occur also on the upper page, the panicles also assume often a paler hue, the flowers and fruits generally are smaller, the latter become less woody and somewhat more slender, and often lose the outward curvature towards the rim; but the fertile seeds of E. terminalis are as a rule provided with a terminal membranous appendage of about the length of the kernel, a characteristic hardly ever occurring in the typical E. corymbosa. An extraordinary variability is also evinced by E. terminalis as regards not only the size of its calyx, but also the manner of its dehiscence, a regular sutural line being sometimes not traceable, necessitating an irregular defraction of the opercular summit; the lid moreover verges sometimes to a flattened form with an almost obliterated apex, or the lid may be quite turgid and its apex very prominent.

E. dichromophloia has the fruits considerably smaller, about the size of those of E. trachyphloia and E. latifolia, besides the bark seems always different, as the specific name implies, from that of E. corymbosa and E. terminalis, its upper thin smooth and pale stratum separating from the brownish-red thick layers below. E. latifolia has very broad even roundish leaves, and belongs on account of its smooth bark to the section Leiophloiæ, unless this be subject to exceptions. E. Abergiana can be separated from E. calophylla and E. terminalis by the want of stalklets of its calyces and from the latter besides by the broader and above dark-green leaves. E. calophylla may be said to replace E. corymbosa in West-Australia, though E. terminalis advances to Nichol-Bay on the west-coast and perhaps still further southward. E. calophylla is however specifically different in several important respects. (*See* F. v. M., report on the Forest-resources of Western Australia p. 4, pl. 2.) The young seedlings of all allied species require yet further comparison.

E. urnigera, which bears in its fruit considerable resemblance to E. corymbosa, differs essentially in having the leaves dark-green and somewhat shining on both sides, the latter moreover are provided with less spreading rather irregular and more distant lateral veins, a removed marginal vein and isogenous stomata, many of the flowerstalks are axillary and bear mostly 3 or occasionally only 2 flowers, the tube of the calyx is more cylindrical turgid below the middle and strongly constricted towards the rim, the lid is ampler than the orifice and seceding by a clear circumcision, the fruit is generally smaller, with more spreading rim, and the seeds are devoid of any appendage. It is moreover never a large tree and restricted to the subalpine zone of Southern Tasmania.

The Very Rev. Canon King noticed Melitose-Manna to a small extent on the leaves of E. corymbosa, when pierced by a phyllophagous Beetle (Anoplognathus cereus).

Explanation of Analytic Details.—1, upper part of an unexpanded flower, the lid lifted; 2, longitudinal section of an unexpanded flower; 3 and 4, front- and back-view of an anther with portion of its filament; 5, style and stigma; 6, stamens in situ; 7 and 8, longitudinal and transverse section of a fruit; 9 and 10, sterile and fertile seeds, one of the latter cut transversely; 11, portion of a leaf; all magnified, but to various extent.



R.Austen del. C.Troedel & C° Lith

F.v.M. direxit.

Steam Litho Gov. Printing Office Melb.

Eucalyptus crebra. *F.v.M.*

EUCALYPTUS CREBRA. W3

F. v. M., in the Journal of the Linnean Society iii. 87 (1858); Bentham, flora Australiensis iii. 221.

Finally tall; leaves scattered, on rather short stalks, elongate- or falcate-lanceolar, sometimes very narrow, of somewhat thin consistence, of equal and dull green on both sides; *lateral veins subtle*, rather numerous, almost parallel and moderately spreading, the circumferential vein very near to the edge; oil-dots much concealed; *umbels paniculated* or some axillary and solitary, on slender stalks, with usually from 3 to 7 small flowers on rather short and thin stalklets; tube of the calyx nearly semiovate, about twice as long as the pyramidal- or hemispheric-conical lid or sometimes not much longer; stamens all fertile, inflexed in bud; *anthers very minute, roundish, opening by ample longitudinal slits;* stigma broader than the short style; fruits very small, semi-ovate, 4- less often 3-celled, their rim rather narrow, the valves deltoid, affixed close below the summit, quite enclosed or provided with slightly exserted points; seeds all without any appendage, the sterile considerably smaller than the fertile seeds and mostly broadish.

From near the southern shores of the Gulf of Carpentaria (F. v. M.) through the more litoral and hilly tracts of Eastern Australia to New England and further southward to the vicinity of Port Jackson and the Blue Mountains, westward to Darling-Downs (W. Hill), chiefly on scrubby ridges and ranges.

A tree, attaining a height of about 100 feet, with a stem-diameter of 3 feet, content with poor soil, known as red or narrow-leaved Ironbark-tree through the wide tracts of its occurrence. *Bark dark, persistent* on stem and branches, almost blackish, ridged and deeply furrowed, solid; but in exceptional geologic situations or perhaps under unusual climatic circumstances the bark occurs also smooth and whitish from decortication in laminar outer strips; still it is far less variable in this respect than E. Leucoxylon; however Mr. Walter Hill sends branchlets of a "Grey Gum-tree" with a note of its being smooth-barked throughout, which cannot be distinguished otherwise from E. crebra. Trunk branching far down or in other cases only ramified towards the summit of the tree. Timber reddish, regarded of superior value, all kinds of Ironbark-trees furnishing tough, elastic, hard and durable wood, locally much in use for fence-posts, railway-crossties, bridge-material, piles, for waggon-building and numerous other technic purposes. Major-General Sir E. Ward, K.C.M.G., found the specific gravity of this wood to be 1·19, and that a piece of 4 feet length and of 2 inches square breadth, when supported on its ends, would bear a weight of 1,792 lbs. before breaking. Mr. F. Byerley found the transverse strain to be able to sustain 710 lbs. when applied to the middle of a quartering of 1 inch thickness and of 1 foot length; thus the wood would not be as strong as that of E. siderophloia and E. maculata.

E. crebra is often gregarious, even so much so in some localities as to constitute the main-bulk of the forests, as is the case in Victoria, Tasmania and South-Australia chiefly with E. obliqua and in West Australia with E. marginata and E. calophylla. The copious occurrence of this tree through a large extent of East-Australia suggested the specific name.

Branchlets very slender and drooping. Oil-pores, particularly in young leaves, occasionally very pellucid. Filaments almost white, their lower portion very flexuous in bud. Fruit slightly attenuated at the base or gradually. The flowering time of this tree is known to fluctuate from March till October according to the geographic latitude of its range and to peculiarities of the climatic regions and seasons. Fruitbearing twigs of an Ironbark-tree with lemon-scented foliage were obtained by Mr. Bailey on the Palmer-River; these seem referable to E. crebra also, although the leaves are shorter and blunter and the peripheric vein is slightly removed from the

edge ; the fragrance of this supposed variety, which might be called *citrata*, is so exquisite, that the leaves can be used as a culinary condiment.

E. crebra might be mistaken for E. largiflorens, not easily in nature, but readily when dried sprigs with imperfect flowers or fruits are to be named ; the latter species recedes by its paler, less furrowed bark, the leaves more conspicuously and darker dotted, the lateral veins less copious, the circumferential vein much more removed from the edge, the anther-cells opening through a pore-like aperture and the lid perhaps generally shorter and blunter.

In rare instances some of the leaves may widen to a broadish form and become opposite, whereby a transit is established to E. melanophloia (the Silverleaved Ironbark-tree), unless indeed the latter is assumed to be the opposite- and sessile-leaved state of E. crebra, analogous to the position held by E. amygdalina and E. Stuartiana to E. Risdoni and E. cinerea. E. melanophloia again is very closely related to E. pruinosa, though differing already in blackish bark ; from E. crebra it is generally differing irrespective of its foliage in longer lid, in fruits somewhat larger and contracted at the orifice and always in the opposite stalks of the umbels in the panicles. It is traced to New England and the Upper Barcoo.

E. drepanophylla, which was advanced with much hesitation as a species (flora Australiensis iii. 221), seems mainly to differ in more stunted habit, larger and stiffer leaves of a paler hue, larger flowers and fruits and perhaps different bark. This species or variety, for the elucidation of which further field-studies are needed, extends northward to the Palmer-River (Th. Gulliver), Cape Sidmouth (C. Moore) and Trinity Bay (Walter Hill) and on the authority of Bentham even to the north-west coast of Australia (Cunningham).

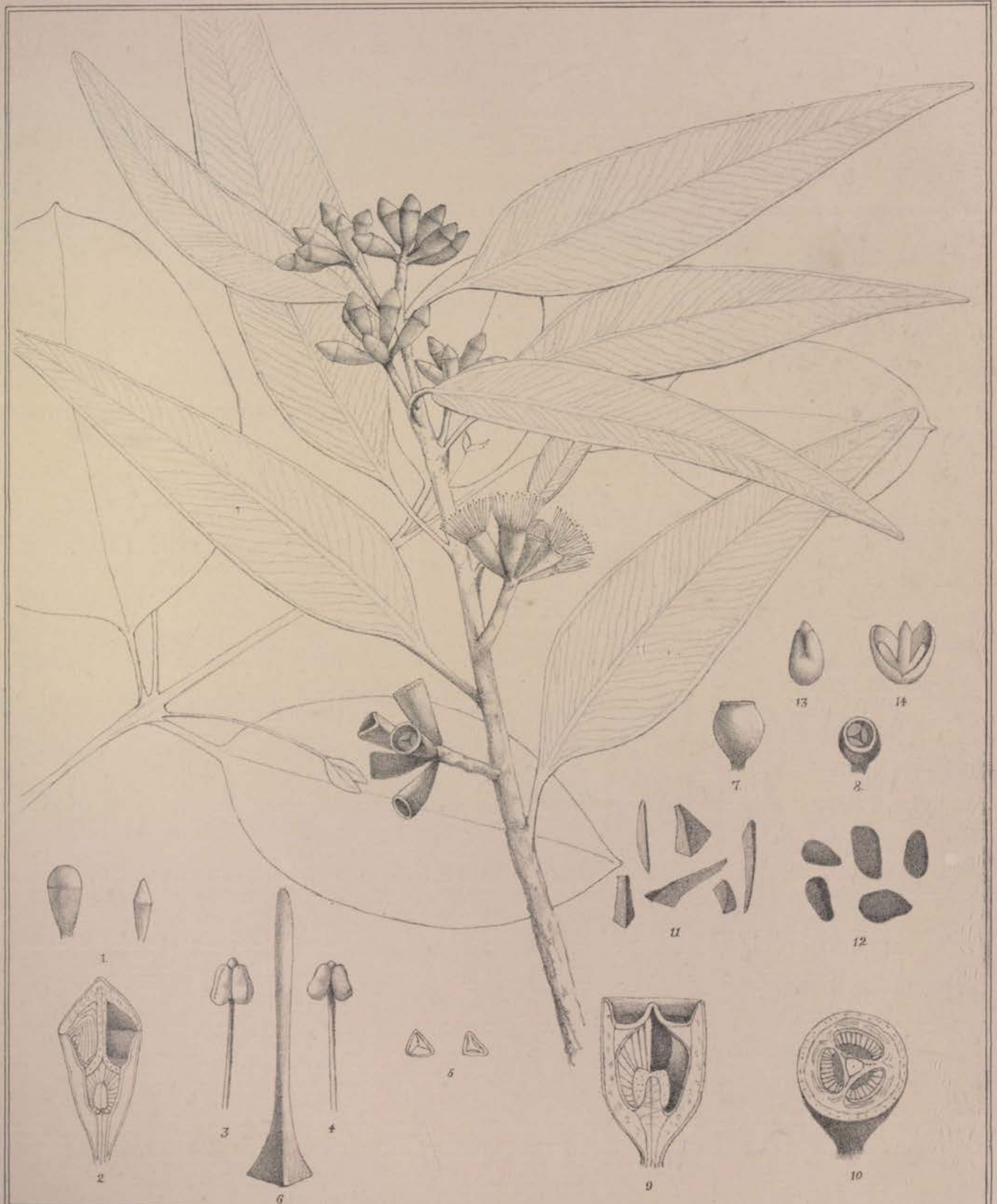
E. leptophleba has the bark more greyish, less furrowed and rather wrinkled, breaking up into numerous small angular pieces in the manner of E. tesselaris ; hence it belongs to the Rhytiphloiæ not Schizophloiæ ; its flowers remained unknown, but its lid is double in an early state of growth. To E. leptophleba seems also to belong a tree, observed by Mr. P. O'Shanesy on the Comet-River, which sheds the outer layers of its bark from the branches and upper part of the stem ; the persistent portion of the bark resembles that of E. tesselaris, but the leaves are more prominently veined and the fruit is often 5-valved and occasionally even 6-valved.

E. angustifolia (Woolls, Lectures on the Vegetable Kingdom with special reference to Australia, p. 123) is a form of E. crebra.

It seems not likely, that E. paniculata will ever be taken for E. crebra, as the leaves of the latter are never much unlike in the color of their two pages, as all the stamens are fertile, the anthers opening in their whole length and the fruits usually smaller and less angular.

Bentham quotes Metrosideros salicifolia (Solander, in Gærtner de fructibus et seminibus i. 171, t. xxxiv. *b.*) as belonging to this species ; the rather slender fruit as illustrated renders the identification disputable. Gærtner described the embryo well. The figure *a* remains still more obscure ; it may belong to E. crebra, E. hæmastoma or E. amygdalina.

Explanation of Analytic Details.—1, unexpanded flowers of different forms, the lid of one lifted ; 2, longitudinal section of an unexpanded flower ; 3 and 4, front- and back-view of an anther with the upper portion of its filament ; 5, style and stigma ; 6, various fruits ; 7 and 8, longitudinal and transverse section of a fruit ; 9, seeds ; 10, embryo ; all more or less magnified.



R. Austen del. et lith.

Baron von Mueller direxit

C. Troedel & Cº imp

Eucalyptus diversicolor. *F.v.M.*

F. v. M., fragmenta phytographiæ Australiæ iii. 131 (1863); Bentham, flora Australiensis iii. 251; F. v. M., Report on the Forest-resources of Western Australia, p. 6, t. 4.

The "Karri."

Finally extremely tall; *leaves* scattered, broad- or elongated-lanceolar, not very inequilateral, slightly curved, evidently *paler beneath; veins very numerous, subtle, pennately spreading*, the circumferential vein somewhat removed from the edge; oil-dots irregular and much concealed; umbels axillary and soon lateral, solitary, their stalks rather long and slender, slightly or not angular, with 3 to 9 flowers; calyces not shining, their tube gradually attenuated into a generally shorter stalklet, somewhat longer or nearly twice as long as the almost hemispheric or semiovate lid, not or slightly angular; stamens all fertile, inflexed before expansion; *anthers almost heart-shaped*, bursting with longitudinal slits, enlarged by a conspicuous dorsal-terminal gland; style shorter than the stamens; stigma not dilated; fruits truncate-ovate, 3- or rarely 4-celled; rim flat, but rather narrow; *valves enclosed, cohering before maturation into a pyramidal cone;* seeds without appendage.

In the moist hilly or mountainous country at and near the Frankland- and Walpole-Rivers, the Shannon, Warren- and Dunolly-Rivers, more particularly towards the coast, extending about thirty miles or less inland, reaching the country near the entrance of the Blackwood-River (J. Forrest), constituting the Karri-forests, occurring sparingly also at the Porongerup and Torbay (F. v. M.) and around Mount Manypeak (Maxwell).

One of the grandest trees of the globe and one of the greatest wonders in the whole creation of plants! Astounding records of the height of this giant-tree have been given. Messrs. Muir saw trees with stems about 300 feet long up to the first branch, and I myself noticed many trees, which approached to 400 feet in their total height. When closely growing, the young trees may have a comparatively slender trunk, so much so, that a tree 180 feet high may show a stem hardly over a foot in diameter; in such a case the foliage, for want of space, is also only scantily developed, and the ramifications are but short in proportion to the tallness of the stems. In the mast-like straightness of the trunk and the smooth whiteness of its bark this superb tree imitates completely the variety regnans of E. amygdalina of South-East Australia, with which also, and perhaps solely, it enters into rivalry as *the tallest tree of the globe!* Even the loftiest trees may not yet have been found out in the secluded humid forest-valleys, in which E. diversicolor like E. amygdalina rejoices most and luxuriates to the greatest extent. But possibly in the 200 miles of uninterrupted length of Sequoia-forests, a few years ago rendered known to exist in Southern California, Mammoth-trees of either Sequoia Wellingtonia or S. sempervirens may occur, which possibly excel in stupendous height even the famous individual trees of the Calaveras-Grove. But whatever species of tree in the championship of the world may gain the final victory for height, no Eucalyptus can compare in the massiveness of its trunk with the Wellingtonia Sequoia, of which one on the Tule-River showed a basal trunk-diameter of 35 feet, while at a height of 240 feet the stem-diameter was still 12 feet with two succeeding limbs respectively 10 and 9 feet across. Still on the authority of Captain Walcott also Karri-stems have been observed with a basal diameter of 20 feet. Into this final competition for height may perhaps also enter some of the true Pines of North-West America (Pinus Douglasii, P. Lambertiana, P. Menziesii, P. grandis) and even the North-East American Pinus Strobus, though its most majestic specimen-trees were long ago swept ruthlessly away from the face of the globe, a fate not unlikely to be shared by its

compeers elsewhere. Widths of timber of as much as 12 feet can be obtained from E. diversicolor. The wood is light-colored, bends freely, is of straight grain and tough, but not so easily wrought as that of E. marginata; it is particularly in request for large planks and sought also for shafts, spokes, felloes and rails; it has also come into use for shipbuilding—for planks, rudders and even masts. According to a note in the West-Australian Catalogue of the Paris Exhibition of 1878 a baulk, which at Cape Leeuwin had been exposed to the wash of the tides since twenty-six years, continued still sound. The durability of the timber, when for lengthened periods underground, has as yet not been proved.

Mr. Th. Laslett (Timber and Timber-Trees, p. 198) states the results of his experiments on the strength of Karri-wood to be as follows. The pieces experimented on for deflection measured 7 feet in length by 2 inches square, six different trials being made :—

DEFLECTION.

	Under a Pressure of 390 lbs.	After the Weight was removed.	At the moment of breaking.	Total Weight required to break each piece.
	Inches.	Inches.	Inches.	lbs.
Maximum	1·35	0·10	7·50	955
Minimum	0·75	0·0	4·60	725
Mean	1·01	0·4	6·06	862½

English Oak of the same dimensions supported a weight of 806½ lbs. (average of twelve trials).

Mr. Laslett's experiments on the tensile strength of Karri-timber gave the following results, the pieces being 30 inches long by 2 inches square : Maximum weight borne, 31,360 lbs.; minimum, 22,120 lbs.; average of six experiments, 28,280 lbs.

Cubes of 6 inches bore a crushing strain of from 175 to 195 tons, average 185 tons, or per square inch 5·14 tons. The specific gravity of the wood was found to be from 0·885 to 1·023, average 0·981.

The first records given by collectors of the bark and other characteristics of this species did not lead to the identification of the huge trees of the Karri-dales; this circumstance and some disparities of characteristics led to the belief, that the gigantic Karri was specifically different, and hence it became temporarily distinguished as E. colossea, under which very impressive designation it chiefly still passes in the countries around the Mediterranean Sea, where this noble Eucalypt, with numerous other species, was first introduced by the writer. The specific name, which by priority has claim on permanency, was derived from the color of the leaves, different on both sides. The growth of the tree is comparatively quick; in poor sandy soil near Melbourne about 23 feet in nine years. The leaves of very young trees assume a broader more oval form, as is the case with many other congeners; in small seedlings the leaves are already conspicuously stalked. Young branchlets compressed-quadrangular. Bruised foliage of Cajuput-odor. Leaves more or less shining above. Unexpanded calyx clubshaped-ellipsoid. Lid rarely broad-conical. Filaments whitish. Anthers dorsifixed. Fruits attaining a length of fully half an inch, moderately contracted towards the orifice. Valves sometimes much narrowed upwards. Fertile seeds dull-black, almost ovate, plan-convex; sterile seeds much more numerous, considerably smaller, light-brown, irregular in form, many very narrow.

Drummond's collections contain this species under Nos. 39 and 59.

E. diversicolor among West Australian species bears some similarity to E. marginata, but the leaves are still paler beneath, the lid is almost constantly shorter, particularly so in proportion to the tube of the calyx, the anthers are not broader than long and their glandular protuberance is much larger, the fruit is longer in comparison to its width, the valves are also longer and the seeds very much smaller; besides bark and wood are totally different.

The Karri-tree cannot in nature be confused with E. patens, the Blackbutt-tree of West-Australia, on account of the greatly persistent and rough bark of the latter, which has besides more curved leaves of almost equal coloration on both sides, the anther-gland very faint, the fruit-rim narrower, the valvular portion of the fruit at first flat and consisting usually of four rarely five pieces, the seeds larger.

What as E. goniantha is mentioned by Bentham from the Frankland-River belongs to E. diversicolor.

The diametric measurement of the woody fibre, and the proportionate number of the medullary rays and vascular tubes, as contrasted with their copiousness in some other kinds of Eucalyptus-woods, is set forth in the following columns, whereby some idea of the relative density of the timber and the closeness of the woody texture may be obtained.

MEASUREMENT OF TRANSVERSE SECTIONS OF THE CELLS OF WOODY FIBRE (PROSENCHYMA).

1. Largest Diameter of Cell.

Eucalyptus marginata (hard)	·00082 inch
marginata (light, dense)	·00082 „
marginata (ordinary, soft)	·00082 „
diversicolor	·00129 „
longicornis	·00070 „
calophylla	·00101 „
loxophleba	·00063 „
salubris	·00055 „
cornuta	·00082 „
rostrata	·00082 „
globulus	·00082 „
Stuartiana	·00082 „
Baileyana	·00105 „
Doratoxylon (young)	·00072 „

2. Thickness of Cellwall.

Eucalyptus marginata (hard)	·00019 inch
marginata (light, dense)	·00024 „
marginata (ordinary, soft)	·00030 „
diversicolor	·00038 „
longicornis	·00029 „
calophylla	·00033 „
loxophleba	·00023 „
salubris	·00023 „
cornuta	·00037 „
rostrata	·00020 „
globulus	·00020 „
Stuartiana	·00015 „
Baileyana	·00025 „
Doratoxylon (young)	·00022 „

NUMBER of Medullary Rays within the space of 1 inch in—

Eucalyptus marginata (dark hard variety)	390
marginata (light dense variety)	260
marginata (soft variety)	330
diversicolor	170
longicornis	290
calophylla	180
Baileyana	315
Eucalyptus loxophleba	330
salubris	470
cornuta	670
rostrata	390
globulus	310
Stuartiana	180
Doratoxylon (young)	330

NUMBER of Vascular Tubes within 1 square inch in the Wood of—

Eucalyptus marginata (dark hard variety)	3,500
marginata (light dense variety)	2,700
marginata (soft variety)	5,100
diversicolor	4,900
longicornis	9,300
calophylla	3,300
Baileyana	10,000
Eucalyptus loxophleba	25,000
salubris	42,000
cornuta	10,000
rostrata	5,700
globulus	3,600
Stuartiana	6,300
Doratoxylon (young)	32,000

These proportions will be subject to some variation, according to the age of the trees. These measurements were made under the author's direction by Mr. L. Rummel.

E. diversicolor seems as hardy as E. globulus, though it may prove less so than E. amygdalina, E. Gunnii, E. pauciflora, E. viminalis and even E. obliqua, E. Sieberiana and E. goniocalyx, among the larger kinds of timber-trees of this genus. Dr. Aberg finds, that on the entrance of the La Plata-River E. diversicolor turns out one of the fastest in growth, and if the species was rightly determined E. corymbosa carried there besides E. globulus the palm, E. obliqua and E. siderophloia coming next in this respect. On the rich alluvial soil there grew also comparatively fast: E. Gunnii, E. Leucoxylon, E. hæmastoma, E. largiflorens, E. longifolia, E. goniocalyx, E. cornuta, E. rostrata, E. tereticornis and E. maculata, but the latter with E. marginata and E. calophylla suffered there from frost. Many grew in that region from two to even five inches daily during the most favorable time of the season!

When gradually through the progress of settlement the harbors between King George's Sound and Cape Leeuwin will be opened up for trade, Karri-timber will become extensively available for export also.

Explanation of Analytic Details.—1, unexpanded flowers of two forms; 2, longitudinal section of an unexpanded flower; 3 and 4, front- and back-view of an anther with portion of its filament; 5, pollen-grains; 6, style and stigma; 7 and 8, lateral and vertical view of a fruit; 9 and 10, longitudinal and transverse section of a fruit; 11 and 12, sterile and fertile seeds; 13, embryo; 14, cotyledons unfolded, to exhibit the radicle; 1, 7 and 8, natural size; 2, 3, 4, 6, 9–14, moderately magnified; 5, enlarged 250 times diametrically.

Bail del.et C.Troedel & Co Lith.

F.v.M direxit

Steam Litho Govt Printing Office Melb

Eucalyptus hemiphloia. *F.v.M.*

F. v. M., fragmenta phytographiæ Australiæ ii. 62; Bentham, flora Australiensis iii. 216; E. albens, Miquel, in Nederlandisk Kruidkundig Archief iv. 138; Bentham, flora Australiensis iii. 219.

Finally tall; leaves scattered, elongate- or oval-lanceolar, of firm consistence, of equal color on both sides, only slightly or sometimes moderately curved, not very shining, the *lateral veins diverging at a very acute angle*, the circumferential vein very evidently removed from the edge of the leaf; oil-dots usually obliterated or much concealed; umbels in lateral or terminal short panicles or some solitary, on angular stalks, with from 4 to 10 flowers; *calyces somewhat angular;* stalklets comparatively thick, of the length of the tube or shorter; lid broadish-conical, rather acute or even pointed, seldom semiovate, about as long as the tube or somewhat shorter; stamens all fertile, inflexed before expansion; *anthers very minute, globular, opening laterally by pore-like apertures;* stigma slightly or not broader than the style; fruits truncated-ovate or hemiellipsoid, 3–5-celled, the *rim narrow-compressed, prominent, valves quite enclosed,* short; seeds without any appendage, the fertile much larger than the short sterile seeds.

Dispersed from Port Jackson (Woolls) to New England (C. Stuart), Glendon (Leichhardt), Toowoomba (Hartmann) and the western districts of New South Wales (C. Moore), Gainsford and Herbert's Creek (Bowman), the Dawson- and Burnett-Rivers (F. v. M.), Mackenzie-River (O'Shanesy), occurring further on the Tambo-River (Howitt) and Snowy-River, also from the Broughton- and Broken-Rivers to Mount Remarkable (F. v. M.), on the Flinders-Ranges up to 2,000 feet elevation (J. E. Brown). It grows on flats, often forming the "box-forests," but principally on rough and dry ridges or hills, yet indicating according to the Revd. Dr. Woolls, often good grazing country.

In the more humid litoral tracts of east- and south-coast Australia this species attains a height of about 150 feet, with a stem of as much as 3 feet thickness (Thozet); in the drier regions of northern Victoria and further westward it is oftener a dwarf tree. The bark of the stem persists, is solid, outside greyish and somewhat wrinkled, but never dark nor deeply furrowed, the outer layers of the bark gradually peel off from most portions of the branches in flakes or long strips. The timber is pale, strong, hard, of close and interlocked grain and not fissile; it furnishes material for lasting fence-posts and various building purposes and wheelwrights' work, also for such sundry utensils as need toughness of wood for their manufacture, as mauls and handles. Posts of this wood after sixteen years were found almost perfectly sound in the ground, but the best timber (as in all other cases of Eucalypts) comes from hilly country. Stems are apt to become hollow in age (J. E. Brown).

Foliage comparatively dense; upper portion of branchlets angular; leaves stiff, conspicuously stalked, often pale-green, but in the eastern coast-districts also dark-green, their veins sometimes prominent, sometimes faint. The tube of the calyx often merging gradually into the stalklet; lid in some instances double, the outer one seceding earlier. Filaments pale or rarely of a deep purplish color, exceptionally $\frac{1}{3}$ inch long; some of the anthers occasionally dilated. Summits of the valves often long cohering and breaking off connectedly. Fruit variable in size, but never large. Dr. Leichhardt found the tree flowering in March, Dr. Woolls in June, particular seasons and localities exercising their effect in this respect. The natives of subtropical Eastern Australia call this tree "Narulgun," according to Mr. O'Shanesy.

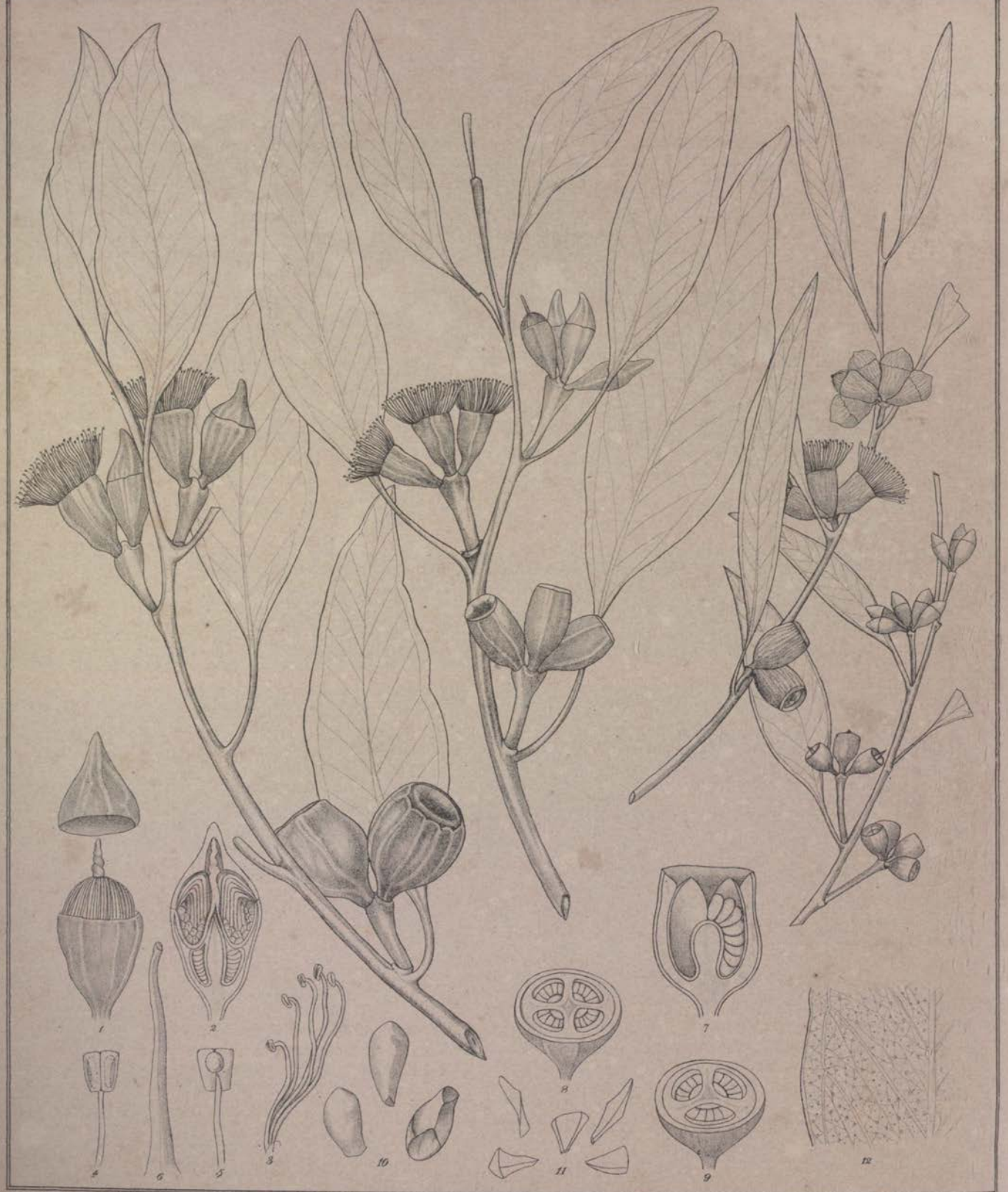
E. albens, which occurs near Mount Remarkable and in some other localities not far from the apex of Spencer's Gulf, also in the vicinity of the Avoca, Loddon, Campaspe, Broken, Ovens and Snowy Rivers (F. v. M.), along the whole valley of the Tambo (Howitt), on the Upper

Murrumbidgee in silurian shales and sandstone, also more or less on all geologic formations on the western slope of the Main Dividing Range of New South Wales down to the tertiary plains (Wilkinson) verging northward to New England (C. Stuart), can be distinguished from the typical E. hemiphloia only in perhaps more extensively persistent bark, in paler dull foliage and chalky-white bloom on the panicles and in calyces somewhat larger and tapering more gradually into a thicker stalklet. The name of E. albens only arose from a misprint of E. pallens and was first promulgated without any diagnosis, and this specific designation is apt to mislead, as the whitish hue, significant of E. albens, and for which it is called "White Box-tree" occurs only in a particular variety chiefly of the western interior, where even this characteristic is often not more remarkable than in several other congeners.

E. hemiphloia is nearest allied to E. populifolia, E. Behriana and E. odorata; from the first it differs in the laminar secession of the bark from the branches, in longer, narrower and less shining leaves, in larger flowers on more elongated stalklets, longer more pointed lid, apertures of the anthers not so close to the summit, and larger and especially more elongated fruits with valves somewhat removed from the orifice.—From E. Behriana, which stands in close relationship to E. largiflorens, it is less easily distinguished in all cases, but it is often of taller stature, not so often remaining shrubby, the bark is lighter in color and not smooth by secession of outer rather dark-brownish layers; the leaves are longer and in proportion to their length usually narrower, also mostly of lighter color, the panicles ampler (those of E. Behriana being comparatively narrow), the flowers and fruits are larger and provided almost as a rule with distinct stalklets, the tube of the calyx is somewhat angular, and the lid is never hemispherical; E. hemiphloia recedes from E. odorata in the external paleness of the persistent portion of its bark, in the more extensive secession of the bark from the branches, in the broader leaves of thicker consistence with less spreading and less copious veins and less distinguishable oil-dots, in not usually solitary axillary umbels, often more acute lid and more deeply inserted valves of the fruit. The reliability of these distinctions should be further traced in South Australia, wherever the two species grow promiscuously. E. hemiphloia seems readily separable from E. Bowmanii by the less spreading veins of the leaves, more paniculate umbels on less flattened stalks, upwards more attenuated lid, stamens much more inflexed while in bud, the openings of the anthers less wide, and the flat top of the ovary, which has a semiglobular-conical summit in E. Bowmanii; the fruit of the latter is not yet available for comparison.

E. drepanophylla, which comes very near to E. leptophleba and E. crebra, belongs to the series of Ironbark-trees (with therefore furrowed and dark-colored bark), has usually narrower leaves of less straightness and of lighter green, with very subtle much diverging and also more copious veins, a shorter lid, anther-cells slit in their whole length and proportionately shorter fruits. To E. drepanophylla verges Bentham's variety parviflora (flora Australiensis iii. 217) mentioned doubtfully under E. hemiphloia; it is according to Fitzalan's note on Ironbark-tree, the anthers however seem not to open with regular slits. The often angular fruit of E. hemiphloia reminds of that of E. goniocalyx, which species however does not pertain to the section Micrantheræ and is moreover recognized already by the flatness of its flowerstalks.

EXPLANATION OF ANALYTIC DETAILS.—1, calyx, the lid lifted; 2, longitudinal section of an unexpanded flower; 3, stamens in situ; 4, and 5, front- and back-view of an anther with portion of filament; 6, style and stigma; 7, longitudinal section of fruit; 8, transverse section of fruit; 9 and 10, fertile and sterile seeds; 11, portion of leaf; all (but variously) magnified.



Tolli del. C.Troedel & Co Lith.

F v M direxit

Steam Litho Gov Printing Office Melb

Eucalyptus incrassata. *Labillardière.*

EUCALYPTUS INCRASSATA. 46

Labillardière, plantarum Novæ Hollandiæ specimen ii. 12, t. 150 (1806); De Candolle, prodromus systematis naturalis regni vegetabilis iii. 217; Bentham, flora Australiensis iii. 231; E. dumosa, Cunningham in Walpers repertorium botanices systematicæ ii. 925; F. v. M., fragmenta phytographiæ Australiæ ii. 59; Bentham, flora Australiensis iii. 230; E. angulosa, Schauer, in Walpers repertorium ii. 925; E. cuspidata, Turczaninow, in Bulletin de la Société des Naturalistes de Moscou 1849, ii. 21; E. costata, Behr & Mueller, in the Transactions of the Victorian Institute i. 33; E. santalifolia, E. lamprocarpa et E. Muelleri, Miquel, in Nederlandisk Kruidkundig Archief iv. 129, 130 and 133; E. fruticetorum, F. v. M., fragmenta phytographiæ Australiæ ii. 57.

Shrubby or hardly arborescent; leaves scattered, ovate- or narrow-lanceolar, sometimes broad-ovate, of thick consistence, of equal and light color as well as shining on both sides; the lateral veins somewhat close, spreading at a rather acute angle and together with the oil-dots much concealed, the circumferential vein visibly distant from the edge; umbels solitary, axillary or subsequently lateral, their *stalks thick, compressed, upwards much dilated* or sometimes more cylindrical, bearing usually from 3 to 8 flowers; stalklets very short or almost or quite undeveloped; *calyces shining, generally streaked with longitudinal prominent lines*, the tube semiovate or somewhat bellshaped; lid about as long as the tube or somewhat longer or conspicuously shorter, turgid towards the base, often rather suddenly protracted into a short or elongated and then slender apex; stamens all fertile and inflexed before expansion; anthers from roundish-oval to almost oblong, opening by ample longitudinal slits; style rather thick; stigma not dilated; fruit semiovate or truncate-ovate, imperfectly or deeply furrowed and streaked, 3–4- rarely 5-celled, the rim oftener narrow than conspicuously broad, seldom flat; valves quite enclosed or their fragile and pointed ends only exserted; sterile seeds usually much narrower than the fertile seeds, all without appendage.

From the Murray- and Darling-Rivers and their lower tributaries through the desert-tracts to the Great Bight, to Cape Leeuwin and to the vicinity of Shark-Bay, chiefly on sand-ridges, but also on tertiary limestone, extending in some places to the brink of the ocean.

A shrub usually of tall growth, with several stems from the same root, exceptionally rising to a tree up to 30 feet, but fruiting already at a height of 4 feet. Bark smooth, outside of a whitish or reddish color, shedding its outer layers successively. Branchlets rather thick, angular and rigid, not pendent. Leaves hardly inequilateral, often terminated by a narrow and curved acumen. Leafstalks of conspicuous length, exceptionally very short. Umbel-stalks sometimes almost wedgeshaped, seldom bearing only two flowers, not rarely curved downward. Lid sometimes slightly wider than the tube of the calyx, occasionally broad-conical or even pyramidal-hemispherical, the end (when beak-like extended) sometimes longer than the turgid basal portion of the lid. Filaments in bud simply inflected, but not flexuous, nor sharply doubled back, comparatively rigid. Some of the anthers occasionally verging to a globular-cordate form; the connective conspicuously glandular-turgid at the back. Style exserted beyond the stamens while they are bent inward before expansion. Fruit-calyx attaining in some cases a length of nearly 1 inch, but that of the small-flowered variety often only $\frac{1}{4}$ to $\frac{1}{3}$ inch long, exceptionally quite hemispherical.

Among the species, constituting the Mallee-scrub on an extensive scale, only E. oleosa belongs also to the Parallelantheræ, from which E. incrassata can be distinguished by its often broad and flat flowerstalks, furrowed or streaked and mostly larger shining calyces, with a lid more depressed towards the base, generally more elongated anthers, as also shorter and therefore less exserted fruit-valves. E. goniantha comes still nearer to E. incrassata, but the leaves are somewhat more distincly sickleshaped, not so shining nor of such even smoothness, but slightly reticulated on their surfaces, the tube of the calyx is comparatively still more deeply furrowed, the attenuated

upper portion of the lid broader and more blunt, while the anthers seem invariably heartshaped-globular, so far as this plant, of which we have as yet no ripe fruit, is known.

E. micranthera, which is closely connected with the arboreous and soft-barked E. decipiens, differs from the genuine E. incrassata particularly in its very short and almost heartshaped anthers, but in other respects comes near to the variety so long separated as E. dumosa.

E. grossa (from which E. pachypoda, F. v. M., fragmenta phytographiæ Australiæ vii. 41 anno 1869, is only separable as a variety) can best be distinguished from E. incrassata by its not distinctly compressed though stout umbel-stalks, by the slightly angular but not furrowed tube of the calyx, by the semiellipsoid even lid, by the filaments inflexed near or towards the summit only, and by its not angular fruit with no narrow apex of the valves.

The specific name, adopted by the French naturalist, seems to refer to the leathery thickness of the leaves, which however is observable in many other species. E. dumosa represents the small-flowered state with generally narrower leaves, only faintly furrowed and ridged calyces, short-pointed lid and scarcely dilated umbel-stalks.

Poiteau's drawing of E. incrassata for Labillardière's work can only with difficulty be reconciled to the species here under consideration, as the lateral veins of the leaves are shown too spreading and too prominent and the calyces quite devoid of furrows and streaks, to which Labillardière neither alludes in his description, although some specimens, which I gathered at King George's Sound, but which are aberrant from the common form of E. incrassata, accord sufficiently with the figure authoritative for this species. To this smooth-fruited variety approaches very closely E. cosmophylla, from the Stringybarktree-forests of the mountains on St. Vincent Gulf, which species shows however more pointed generally broader and less shining leaves with more visible veins, the flowers less in number and on a shorter common stalk and rather an increase in the number of fruit-valves.

E. Planchoniana approaches in some of its characteristics E. incrassata, but irrespective of its not belonging to the desert-country, it is a comparatively tall tree, the leaves are longer, not so shining, have more spreading, more distant and more prominent veins and their stomata only on the lower page, the tube of the calyx is less turgid, the lid more gradually attenuated upwards, the anthers are never elongated to an oblong form, the outer stamens are not bent downward while in bud, but are somewhat flexuous, the valves of the fruit are not narrowly attenuated at their apex, and the fertile seeds are more angular.

E. incrassata is one of the prevailing species among those, which widely constitute the dense "Mallee-scrub," and plays thus an important part in the natural economy of the desert, aiding to mitigate the excessive heat and the effect of Sirocco-like blasts of widely arid regions by its enormous power of evaporation, in which respect Eucalypts generally far surpass most other kinds of trees, the power of their roots for drawing up and absorbing humidity from the soil being also very great. It is well known that E. incrassata, E. microtheca and E. oleosa will yield water to a parched traveller from their roots.

Explanation of Analytic Details.—1, unexpanded flower, the lid lifted; 2, longitudinal section of unexpanded flower; 3, some stamens in situ; 4 and 5, front- and back-view of an anther, with portion of its filament; 6, style and stigma; 7, longitudinal section of a fruit; 8 and 9, transverse section of fruits; 10 and 11, fertile and sterile seeds; 12, portion of a leaf; all magnified, but to various extent.

Vail del. C. Traeder & Co. Lith. F.v.M. direxit. Steam Litho. Gov Printing Office. Melb.

Eucalyptus largiflorens. *F.v.M.*

F. v. M., in the Transactions of the Victorian Institute i. 34 (1854); fragmenta phytographiæ Australiæ ii. 58; E. pendula, A. Cunningham, in Steudel's nomenclator botanicus p. 600 (1840); E. bicolor, A. Cunningham, in Mitchell's Tropical Australia 390 (1848); F. v. M., in the Journal of the Linnean Society iii. 90; Bentham, flora Australiensis iii. 214.

Branchlets slender; leaves scattered, elongated- or very narrow-lanceolar, rather straight or slightly sickleshaped, of thin consistence, gradually narrowed into a comparatively short stalk, generally pale and dull-green on both sides; lateral *veins extremely fine, diverging at a very acute angle* or not very spreading nor quite close, the circumferential vein somewhat removed from the edge; oil-glands numerous, often transparent; *umbels in lateral or terminal short panicles*, with 3–8 flowers in each; calyces small, on stalklets of usually less length; *lid double, the inner one hemispherical* or slightly pyramidal, hardly half as long as the almost obconical-semiovate scarcely angular tube, the outer lid when present much smaller and slightly elevated; stamens all fertile, unless some of the outer imperfect, inflexed before expansion; *anthers globular, opening by lateral pores;* style very short; stigma hardly dilated; *fruit very small, truncate-ovate* or slightly bell-shaped, 3- or oftener 4-celled; the rim rather narrow, the valves very short, convergent and quite enclosed, but not distant from the rim; seeds minute, without appendages.

From St. Vincent's Gulf and the Murray-River and its lower tributaries through Eastern Australia and particularly its inland-tracts to Carpentaria, at least as far as the Flinders- and Gilbert-Rivers, but reaching also in some places the coast-tracts.

A tree, attaining in desert-regions only a height of about 30 feet or remaining more or less shrubby, but in litoral regions rising to about 90 feet, passing as one of the "Box-trees," occupying either moist places or banks of watercourses or depressions in the Mallee-scrub. *Bark persistent* in the ordinary state of this species on the branches as well as on the stem, blackish-grey, rough and hard. Branches more or less drooping, sometimes as much so as those of the Weeping Willow. Leaves occasionally a span long, but usually rather short,—in trees from the east-coast, which seem as a variety to belong to this species, also vivid-green and somewhat shining. Stalks of the umbels neither elongated nor dilatated. Stalklets sometimes extremely short. Outer lid not always independently developed or very fugacious or consolidated with the inner one. Filaments in bud, irrespective of their sudden infraction, also flexuous, cream-colored as in most congeners or occasionally crimson; the anthers of the outer filaments sometimes diminutive or almost obliterated, or rarely a few of them enlarged and deformed. Valves exceptionally 5.

This is not the only instance of tall eastern species extending far into the western interior and there becoming dwarfed in growth, E. paniculata and E. hemiphloia being other examples in this respect.

The supposed tall variety from the Queensland coast-districts, with longer leaves of more saturated and rather shining green, sheds the outer layers of its bark completely, according to a note of Mr. Dallachy, but seems not specifically different. Similar instances are well known in regard to the coloration of the foliage of Tecoma australis, Carissa Brownii, Geijera salicifolia and Jasminum simplicifolium, which produce dark-green shining leaves in humid forest-regions, but assume gradually a pale and dull hue as these plants advance towards the arid interior. The lamellar secession of the bark in trees of this species in coast-forest and its persistence in dry open regions finds a repetition under similar circumstances in E. amygdalina and several other congeners. The stalklets in this variety from the tropical coast are rather longer and the lid

more pyramidal. Mr. O'Shanesy records from the Dawson-River and Nagoa trees with bark black on the stem and grey and smooth on the limbs.

Preference is here given, in accordance with De Candolle's code, to the name under which this species was first defined, and chosen as expressive of the exuberance of its flowers. Of neither of the names, bestowed by Allan Cunningham on this species, timely description was given; the pendulous branches suggesting the one name and perhaps the sometimes red but often pale color of the filaments giving rise to the other, unless it was derived from the coloration of the bark. Crimson filaments seem however not to occur frequently, though the writer has seen flowers of such mixed with others of pale-colored stamens in the same panicle. Flowers with red filaments are less rare in E. Leucoxylon, occur also in E. Behriana, according to Mr. T. Shepherd rarely in E. hemiphloia and seemingly likewise in E. siderophloia. They are perhaps always red in E. erythronema (Turczaninow, in Bulletin de l'Académie des Sciences de St. Petersbourg 1852 p. 415; E. conoidea, Bentham, flora Australiensis iii. 227).

The resemblance of E. Behriana to E. largiflorens is very great, but the former has more erect branchlets, also stiffer, broader and more shining leaves, the flowers almost unprovided with stalklets, besides often longer fruits.

E. odorata again is distinguished by the generally broader leaves, simple axillary umbels, more elongated calyces tapering rather more gradually into the stalklets, by longer lids, larger anthers and longer fruits not contracted at the orifice.

E. microtheca shows more numerous and very spreading veins of the leaves, the circumferential vein almost contiguous to the edge, anthers opening by slits not pores, fruits remarkably distended at the orifice with protruding valves.

E. crebra may be distinguished easily by its dark rugged bark—belonging to the series of the Ironbarks—further by the fine close and very spreading veins of the leaves and by the anthers opening by fissures.

Bentham's var. parviflora of E. largiflorens belongs to E. populifolia.

EXPLANATION OF ANALYTIC DETAILS.—1, unexpanded flower with a double lid; 2, unexpanded flower, the lid lifted; 3, longitudinal section of an unexpanded flower; 4 and 5, stamens in situ, either all fertile or some sterile; 6, 7 and 8, back-, side- and front-view of an anther with portion of its filament; 9, style with stigma; 10 and 11, transverse and longitudinal section of fruit; 12 and 13, fertile and sterile seeds; 14, portion of a leaf; all magnified, but in various degrees.

R.Austen del et lith. F. v. M. direxit. Steam Litho. Gov. Printing Office, Melb.

Eucalyptus paniculata. *Smith*

Smith, in the Transactions of the Linnean Society iii. 287 (1797); De Candolle, prodromus systematis naturalis regni vegetabilis iii. 220; Kippist, in F. v. M. fragmenta phytographiæ Australiæ ii. 174; Bentham, flora Australiensis iii. 211; E. fasciculosa, F. v. M., in the Transactions of the Victorian Institute i. p. 34; Miquel, in Nederlandisk Kruitkundig Archief iv. 138.

Finally tall; *leaves* scattered, of rather thin consistence, narrow- or elongate- or sometimes broad-lanceolar, slightly curved or somewhat sickleshaped, *paler and dull-colored beneath*, hardly shining above, their lateral veins very spreading, subtle and numerous, the *marginal vein almost contiguous to the edge of the leaf;* oil-pores irregular, mostly angular, soon concealed; *umbels paniculated* or a few axillary and solitary, on slender angular stalks, each with from 3 to 8 flowers; tube of the calyx broad-obconical, gradually becoming angular, attenuated into a stalklet of generally lesser length, longer and broader than the pyramidal- or hemispheric-conical almost membraneous lid or sometimes the latter almost as long as the tube; *outer stamens sterile;* filaments all infracted before expansion; *anthers minute, quadrangular-roundish, opening with pores at the truncated summit; stigma dilated*, evidently broader than the summit of the style; fruit truncate-ovate, attenuated at the base or verging into a truncate-pearshaped form, slightly contracted at the summit, 3–4- or rarely 5-celled, lined with 2 to 4 angular streaks, never large; their rim narrowly compressed; valves almost deltoid, quite enclosed; seeds all without appendage, the sterile seeds exceedingly short, angular and comparatively broadish; testa of fertile seeds reticulated.

In New South Wales from the coast to the Blue Mountains and New England (Leichhardt), extending there southward at least as far as Illawarra (Kirton); the variety fasciculosa on dry particularly sandy ridges and also on stony ranges near the Murray-River and St. Vincent's Gulf (F. v. M.), at Lacepede-Bay (Babbage) and some intermediate places, also in Kangaroo-Island (Waterhouse).

This species passes at or near the east-coast as the "Red Ironbark-tree," according to the Revd. Dr. Woolls, on account of its persistent hard rough bark and reddish dark timber. In South-Australia it is a White Gum-tree, seldom rising there above 30 feet, even often of less height, with the outer layers of bark deciduous, leaving the stem grey and white-mottled and smooth (McEwin). It flowers in a shrubby state already. These two races of E. paniculata differ furthermore in their foliage and in some other respects. Thus the leaves of the typical E. paniculata of Eastern Australia have their upper page much darker than the lower one and the stomata are hypogenous only, varying as far as observed from 137,000 to 186,000 on the square inch, whereas the difference in the coloration of both sides of the leaves is not striking, indeed pale also above in E. fasciculosa, the stomata being amphigenous, counting about from $\frac{20,000}{130,000}$ to $\frac{21,000}{132,000}$. Moreover the flowers of the variety fasciculosa are smaller, the lid is proportionately shorter and still more thinly membraneous; but the foliage and inflorescence of E. paniculata assumes in New England also exceptionally a glaucous hue.

From E. melliodora the species here under consideration can be distinguished by mostly longer leaves with finer and more spreading veins and with the intramarginal vein nearer to the edge, further by more decidedly paniculate flowers, the somewhat angular calyx, which is more gradually attenuated into its stalklet, by the rather longer fruit-calyx with the rim inside long-descending but outside neither emerging nor annular.

The differences of E. paniculata from E. largiflorens consist in the contrasting paleness of the lower page of the leaves and in their more copious and more divergent but less prominent veins, in the close approach of the circumferential vein to the margin of the leaf, in the pointed lid, in the deprivation of many of the outer stamens of their anthers and in the narrower rim of the fruit-calyx. It is also generally a taller tree, rising to 150 feet.

From E. gracilis it differs again in the inequality of the color of the upper and the lower side of the leaves, which are moreover of larger size, in the paniculated inflorescence, more angular anthers not opening at a distance from the summit, and dilated stigma.

E. crebra and E. microcorys are also not dissimilar to E. paniculata, and mere fruiting sprigs of these three might easily be referred to the wrong species, but in a flowering state the mode of dehiscence of the anthers distinguish them easily from each other, irrespective of several other characteristics.

From the principal Ironbark-tree of New South Wales, namely E. siderophloia, we can best distinguish E. paniculata by the less deeply furrowed bark, by the frequent difference in the coloration of the leaf-pages, by the shorter calyx-lids, the sterility of the outer stamens, the infraction of all filaments while in bud, the terminal openings of the anthers, the dilated stigma and perfectly enclosed fruit-valves.

The twigs of E. paniculata are very lax and slender in either variety. The wood is very durable and extensively used by coachbuilders and wheelwrights; it is often darker than other kinds of Ironbark-timber, but not so tough as that of E. siderophloia. The calyces are generally of pale color. The filaments are almost white, finely capillary, and while in bud slightly flexuous, irrespective of being doubled back. The period of flowering seems a long one, at least that of the variety occurring in South Australia, where blooming panicles have been gathered from December till May; they are not much scented. The terminal pores of the anthers this species has in common with E. Leucoxylon, E. melliodora and E. polyanthema. The stigma is dilated, sometimes as much as that of E. Leucoxylon. The angularity of the calyx is hardly noticeable in the fresh flowers, but becomes obvious in dried specimens. By an oversight an error of the draftsman has been passed, who delineated the anthers as opening with longitudinal slits instead of terminal pores.

The Rev. Dr. Woolls found this Eucalypt flowering more regularly than many other congeners, and noted also, that it produced Kino in considerable quantity and that the bark is not so rugged as that of E. Leucoxylon var. Sideroxylon, but that the wood is easier worked than that of the latter.

EXPLANATION OF ANALYTIC DETAILS.—1, upper portion of an unexpanded flower, the lid lifted; 2, longitudinal section of an unexpanded flower; 3 and 4, front- and back-view of an anther with portion of its filament; 5, style and stigma; 6, some stamens in situ; 7 and 8, longitudinal sections of two fruits; 9, transverse section of a fruit; 10 and 11, sterile and fertile seeds; all magnified, but to various extent.

Publ. del. & Trusted & Co Lith.

F.v.M. direxit.

Steam. Lithic. Gov. Printing Office Melb.

Eucalyptus ptychocarpa. *FvM.*

F. v. M., in the Journal of the Proceedings of the Linnean Society iii. 90 (1858); Bentham, flora Australiensis iii. 255.

Finally rather tall; *leaves* large, scattered, from broad-oval verging into an elongate-lanceolar form, straight or somewhat sickleshaped, *paler and dull-colored beneath; lateral veins subtle, numerous, almost transversely spreading,* the circumferential vein nearly contiguous to the margin of the leaf; oil-dots concealed or obliterated; umbels terminal, paniculated, with 3 to 7 *large flowers;* stalks almost cylindrical; stalklets angular; *calyces ridged by about* 8 *longitudinal prominent lines,* the tube almost bellshaped or topshaped, twice or thrice as long as the nearly hemispheric lid; stamens all fertile, *filaments scarlet,* inflexed before expansion; anthers oval, bursting with longitudinal slits; style rather thick; *fruits large, truncate-ellipsoid* and slightly urnshaped or bellshaped, 4-celled, longitudinally lined by about 8 ridges, the vertical margin not very broad, but suddenly and amply descending to the orifice; *valves deeply enclosed; the fertile seeds produced into a rather large terminal appendage,* the sterile seeds much narrower.

Along rocky rivulets and also on the margins of exsiccating watercourses towards the sources of the Wentworth-, Wickham- and Limen Bight-Rivers (F. v. M.); on Melville-Island (Fraser); near Port Essington (Gilbert); at the mouth of the Liverpool-River (B. Gulliver).

A middle-sized or rather large tree, with a *greyish wrinkled everywhere persistent somewhat fibrous bark,* thus fluctuating between the Stringybark- and the so-called Box-trees, though in cortical characters perhaps nearest to E. hemiphloia and E. albens; but the accurate histologic examination of these and numerous other species in reference to their bark remains hitherto incomplete, though such would reveal in all probability important characteristics not only for specific discrimination, but also perhaps for industrial applications. Leaves conspicuously stalked, not rarely a span long, occasionally exceeding even a foot in length; their margin narrowly recurved as in all species with only hypogenous stomata. Flowerstalks from ½ to 2 inches long, the stalklets still more variable in length, as well as the calyces often covered with a whitish in age evanescent bloom. Anthers dorsifixed. Fruits lignous, 1 to 2 inches long. Valves horizontal, deltoid. Fertile seeds about 2 lines long, with an almost oval appendage extending additionally to 3 lines; the appendage of the sterile seeds very narrow.

The description could only be prepared from scanty material. Mr. B. Gulliver, who saw the tree during Captain Cadell's discovery-voyage to the coasts of Arnhem's Land, states the flowers (filaments) to be scarlet. If really they participate in the bright color of E. miniata and E. phœnicea, we should have an additional highly ornamental species to select for our arboreta even here far south, as the intratropical Eucalypts proved in my experience quite hardy, wherever the thermometer does not sink below zero longer than a few hours at a time. It is mainly for this reason, that attention is drawn to this species now, although it may perhaps also prove a quick growing timber-tree of value for moist tropical climes, in places where many of the extratropical Eucalypts do not prosper.

Its affinity is with E. Abergiana and E. miniata; from the former it can be distinguished by its longer leaves with a still paler lower page, by its also still larger flowers, which are provided with usually long stalklets (although Bentham describes the latter as occasionally also very short), and most particularly by the fruit longitudinally traversed by about eight narrow ridges.

From E. miniata it is far more distinct in its not scaly-friable bark, which does not separate from the main branches, in the leaves being not of a pale and dull-green on both sides, besides

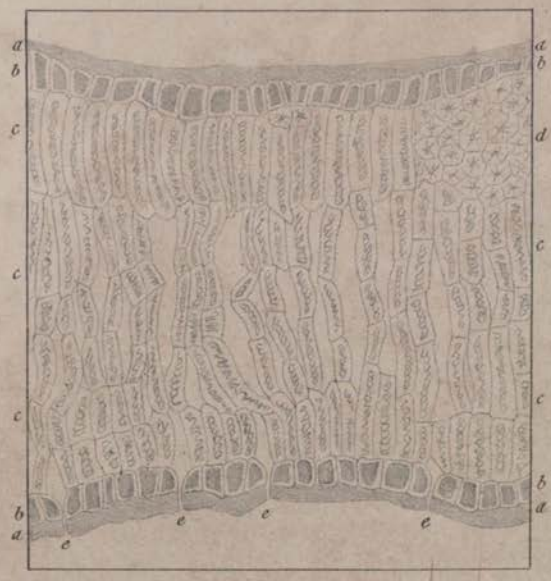
of thicker consistence, much larger and proportionately also broader, without any translucent oil-dots, in the absence of stomata on the upper page of the leaves ; further in the umbels not solitary nor lateral nor axillary, in larger flowers and conspicuous development of flower-stalklets, in fruits often smaller (although similarly shaped and ridged) and in the seeds provided with a long appendage (those of E. miniata being quite exappendiculate).

The alliance of E. ptychocarpa to E. Watsoniana is so much more remote, as to render a detailed exposition of their specific differences unnecessary. The leaves of E. ptychocarpa show on transverse section their chlorophyllous parenchyma-cells mostly in seven rows. The same numbers of series occur in E. calophylla, E. corynocalyx, E. diversicolor and E. viminalis, but in E. globulus these cells are stratified in eleven layers. Extended observations may however prove the numbers of the series, as above given, subject to some variation, but they may within certain limits be of diagnostic value. In the leaves of young seedlings of E. viminalis the number of cell-strata was found the same as in the leaves of aged trees, but the cells are smaller.

EXPLANATION OF ANALYTIC DETAILS.—1, unexpanded flower, the lid lifted ; 2, longitudinal section of an unexpanded flower ; 3, some stamens in situ ; 4, 5 and 6, back-, front- and side-view of an anther with portion of its filament ; 7, style and stigma ; 8 and 9, transverse and longitudinal section of a fruit ; 10 and 11, fertile and sterile seeds ; 12, portion of a leaf ; 1–7 and 10–12, variously magnified ; 8 and 9, natural size.

EXPLANATION OF LITHOGRAM OF EUCALYPTUS LEAVES, THE SECTIONS VERTICAL.—1, *Eucalyptus ptychocarpa : a*, cuticle ; *b*, epidermal cells ; *c*, parenchyma-cells in 5–7 rows, 7 prevailing, with chlorophyll ; *d*, grit-cells (sclerenchyma) ; *e*, breathing pores (stomata) on the lower side only.—2, *Eucalyptus calophylla : a*, cuticle ; *b*, epidermal cells ; *c*, parenchyma-cells in 6–7 rows, 7 prevailing, with chlorophyll ; *d*, grit-cells ; *e*, breathing pores on the lower side only ; *f*, oil-gland ; *g*, oleo-resin.—3, *Eucalyptus globulus : a*, cuticle, *b*, epidermal cells ; *c*, parenchyma-cells with chlorophyll in about 11 rows ; *e*, breathing pores (occurring on both sides, but the upper portion of the section omitted on account of the thickness of the leaf) ; *f* and *g*, oil-gland, containing oleo-resin.—4, *Eucalyptus viminalis : a*, cuticle ; *b*, epidermal cells ; *c*, parenchyma-cells, in 5–7 rows, 7 prevailing, with chlorophyll ; *d*, grit-cells ; *e*, breathing pores on both sides.—Augmentation in all these instances 214 times, diametrically measured.

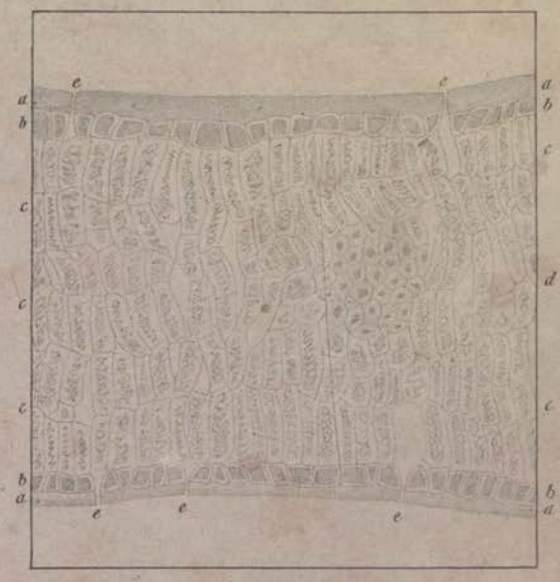
1



2

3

4



L.Rummel del. C.Troedel & Cº Lith. P.y M. direxb. Steam Litho dov Printing Office, Melb.

Eucalyptus leaves. *Transverse sections.*

Ioël del. C. Troedel & Cº Lith. F. v M. direxit. Sloan Litho Gov Printing Office Melb

Eucalyptus trachyphloia. *F. v M.*

EUCALYPTUS TRACHYPHLOIA. 50

F. v. M., in the Journal of the Proceedings of the Linnean Society iii. 90 (1858); Bentham, flora Australiensis iii. 221; F. v. M., fragmenta phytographiæ Australiæ xi. 43.

Finally tall; *leaves* scattered, narrow- or elongate-lanceolar, slightly or sickleshaped-curved, rather *paler and not shining beneath, their lateral veins very subtle and numerous, feathery spreading,* the circumferential vein almost contiguous to the slightly recurved edge of the leaf, the oil-dots copious and translucent, sometimes much concealed; *umbels paniculated,* on slender stalks, with 8 or less very small flowers, the latter provided with thin stalklets of nearly the same or less length; *calyces* ovate-pearshaped before expansion, *tardily ruptured along the transverse somewhat irregular sutural line; the lid depressed-hemispherical, not so broad as the tube* and several times shorter; stamens all fertile; anthers ovate, somewhat truncated, bursting with parallel fissures; style very short; stigma but slightly dilated; *fruits rather small, urnshaped-ovate,* slender-stalked, smooth, 3- rarely 2-celled; their rim very narrow; valves deltashaped, deeply enclosed; seeds without any appendage, the sterile much smaller than the fertile seeds.

In poor hilly country, hitherto traced from Moreton-Bay (Bailey) to the Burnett-River (F. v. M.) and the MacKenzie-River (Bowman, O'Shanesy), chiefly in the sandstone-formation.

A tree, passing in colonial language as one of the Bloodwood-trees, attaining a height of 80 feet with a stem-diameter of 2 feet, but in exposed situations on the tops of hills dwarfed in growth and fruiting already in a shrubby state. Timber pale, flexuous in fibre. Bark persistent on the branches as well as on the stem, outside greyish-brown, irregularly fissurated and frustular, inside far more woody than fibrous, but not ponderous, pale-brownish. Leaves somewhat shining and darker above; stomata hypogenous only. Panicles terminal. Lid separating from the tube of the calyx not so much by a clear circumcision as by a fracture, thus often adhering on one point to the tube while the stamens are fully expanded, occasionally of only half the width of the tube, rarely somewhat pyramidal. Filaments white. Anthers dorsifixed. Fruit-calyces sometimes less contracted and then truncate-ovate. Seeds not very numerous, the fertile seeds in proportion to the capsular part of the fruit rather large, about 1 line long, ovate, plan-convex, fixed at the centre.

In this as in some other instances the definition of the species was elaborated from a very limited number of specimens; to give descriptions their fullest scope they should rest on examinations of trees instituted in the forests of many localities, for which purpose, as a rule, the opportunities arise only in the course of lengthened periods. Thus we are also unacquainted yet with the form of the seedling of this species.

The specific name of this tree was suggested by the roughness of the bark, conspicuous not less on the branches than on the stem. The timber seems not of leading value, but the tree is eligible, as mentioned by Mr. Bailey, for its shade in dry hot localities. More important in reference to its Kino, this species is pressed on our attention. The analysis of one sample gave us here as much as 73 per cent. of Kino-tannic acid (soluble in water and alcohol and precipitable by acetate of lead out of an acidified solution); 18½ per cent. Kino-red or allied substance (insoluble in water, but soluble in alcohol); 8½ per cent. gum and pigment (soluble in water and partly in alcohol, but not precipitable by acetate of lead).

The systematic position of the species is in the series of the Bloodwood-trees, to which E. corymbosa, E. terminalis, E. Abergiana and their allies belong, notwithstanding the smallness of its flowers, although in this and some other respects E. trachyphloia approaches E. crebra and

some cognate Ironbark-trees, all of which however have the stomata isogenous and show a clear line of dehiscence, by which the lid is separated, while the difference of the anthers separate them even sectionally according to Bentham's system. Besides in E. crebra the lid is not depressed, the fruit is not or less contracted at the summit, and the valves are almost terminal. Its real systematic place should be next to E. dichromophloia, from which it can be distinguished in rougher bark, in thinner less elongated leaves of a darker green above and dull paleness beneath (therefore not of equal color on both sides) with recurved edge, in the want of stomata on the upper page of the leaves, in the calyces of less polished smoothness, in smaller fruits with perhaps never or only rarely four valves, and in the absence of any appendage to the fertile seeds.

EXPLANATION OF ANALYTIC DETAILS.—1, unexpanded flower, the lid partly detached; 2, longitudinal section of an unexpanded flower; 3, some stamens in situ; 4, 5 and 6, front-, side- and back-view of an anther with portion of its filament; 7, style with stigma; 8, longitudinal section of a fruit; 9, transverse section of two fruits; 10 and 11, fertile and sterile seeds; 12, portion of a leaf; all magnified, but to various extent.

EUCALYPTOGRAPHIA.

A DESCRIPTIVE ATLAS

OF THE

EUCALYPTS OF AUSTRALIA

AND THE

ADJOINING ISLANDS;

BY

BARON FERD. VON MUELLER, K.C.M.G., M. & PH.D., F.R.S.,

GOVERNMENT BOTANIST FOR THE COLONY OF VICTORIA.

"NON SUCCIDES ARBORES, NEC SECURIBUS DEBES VASTARE EARUM REGIONEM."—*Liber Deuteronomii* xx. 19.

SIXTH DECADE.

MELBOURNE:

JOHN FERRES, GOVERNMENT PRINTER.

PUBLISHED ALSO BY GEORGE ROBERTSON, LITTLE COLLINS STREET.

LONDON:

TRÜBNER AND CO., 57 AND 59 LUDGATE HILL; AND GEORGE ROBERTSON, 17 WARWICK SQUARE.

M DCCC LXXX.

Todt del. C. Troedel & Cº Lith. F.v.M. direxit. Steam Litho Gov. Printing Office, Melb.

Eucalyptus buprestium. *F.v.M.*

EUCALYPTUS BUPRESTIUM. 51

F. v. M., fragmenta phytographiæ Australiæ iii. 57 (1862); Bentham, flora Australiensis iii. 205.

Shrubby or somewhat arborescent; leaves small, scattered, on rather short stalks, narrow- or sickleshaped-lanceolar, of equal color and slightly or hardly shining on both sides; their lateral veins rather thin, moderately spreading, not of very close approach, the circumferential vein slightly removed from the edge; oil-dots much concealed or obliterated; umbels axillary or lateral and solitary or a few crowded on short lateral branchlets, their stalks slender, bearing 4–10 or rarely only 3 flowers; *calyces small, almost pearshaped,* not angular, longer than their thin stalklets; tube of the calyx nearly twice as long as the hemispheric lid; stamens all fertile, inflexed before expansion; *anthers cordate-kidneyshaped,* the outer ones opening by divergent short slits, the inner ones by more roundish large pores; stigma not broader than the style; *fruits large,* nearly globular, pale-greyish, on very short or hardly any stalklets, 3- to 4- rarely 5-celled, not angular, the orifice of from twice to four times less width than the breadth of the middle portion of the fruit; rim prominently edged; valves quite enclosed, deltoid; fertile seeds very angular, not much differing in size from the rather large and broad sterile seeds, but edged by a rather conspicuous membrane.

In Western Australia on sandy plains and ridges near Kojoneerup, also near the Palinup- and Salt-Rivers (Maxwell); on shrubby undulations north of Stirling's Range and thence extending, though not continuously, to the sand-scrubs near the Arrowsmith-River (F. v. M.).

A shrub, noticed to attain generally only a height of about 10 feet, but occasionally advancing to the size of a small tree, as seen by me towards the sources of the Greenough- and Irwin-Rivers. Branchlets mostly somewhat angular. Leaves seldom over 3 inches long, often shorter, some of them occasionally only 1 inch in length, somewhat rigid. Umbel-stalks slightly angular, ½ to ¾ inch long; lower portion of the filaments not flexuous in bud. Anthers centrally dorsifixed, oscillating, the outer ones slightly larger and comparatively rather broader, very pale everywhere except their minute terminal brownish gland. Style shorter than the stamens. Fruit sometimes attaining fully to 1 inch dimension, but producing ripe seeds also at half that size. Orifice variable in width, but always of much less diameter than that of the middle portion of the fruit; the rim in some instances abruptly descending, rendering the edge very narrow, in other cases the rim remaining more horizontal, thus forming a broadish margin around the orifice. Seeds in generally two rows closely packed in each cell, shining, very few fertile, and these from a convex summit angularly attenuated to the basal hilum.

A remarkable feature in this species is the size of the fruit, very large in proportion to that of the flowers, the disproportion in this instance being greater than in any other congener hitherto known.

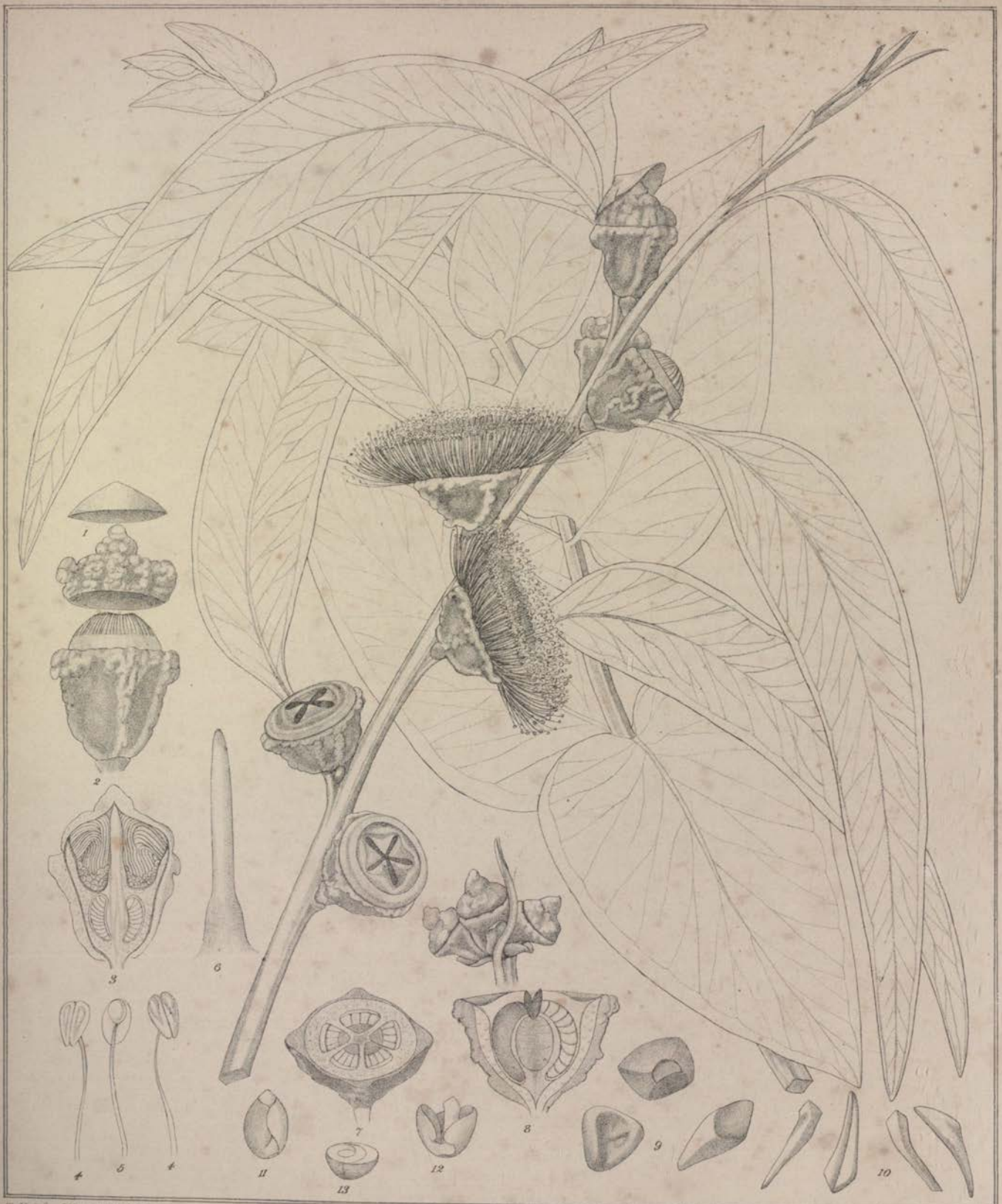
In Bentham's system this species takes its place among the comparatively small series of those of the Renantheræ; this alone renders its recognition quite easy, as that series comprises only one other West-Australian species, namely E. marginata, and seemingly also only one other constantly shrubby or scarcely arborescent species, viz. E. stricta.

Eucalyptus-vegetation generally is favorable to the production of honey, and to this rule E. buprestium offers no exception; indeed the sweet nectar-fluid of the flowers of this Eucalypt seems particularly rich, so much so, that some of the beautiful Buprestis-beetles are particularly attracted by it; hence the specific name. Perhaps the only utilitarian value, which this species

could claim, would be its adaptability to grow on mere sand, which it would help to solidify, to cover with shelter and shade where needed, and to convert finally into pasture-land.

Mr. Otto Tepper confirms indirectly my supposition, that it is the nectar-fluid of the flowers, which attracts some buprestideous beetle to this species ; inasmuch as he observed, that about the month of February in Yorke's Peninsula large numbers of gigantic and beautiful Stigmodera-beetles of four species take possession of Eucalyptus uncinata, which at the time is in full bloom. In the afternoon and evening they were found almost exclusively among the flowers and engaged in imbibing the nectar, which with perhaps delicate portions of the flowers seems to form the nourishment of these buprestidæ. Mr. Tepper never saw them feed on the leaves of Eucalypts, as is the case with some other beetles. The females of these Stigmoderas deposit their eggs under the loose dry bark of the branches ; the larvæ feed at first under the bark, then through the sap-wood into the centre of the stem, always downward, until they reach the bottom of the tree, where they form tortuous oval galleries. These particular Stigmoderas, according to information gained by Mr. Tepper from the settlers, do not occur every year ; but one distinct species frequents E. oleosa, but never numerously, although annually.

Explanation of Analytic Details.—1, an unexpanded flower, its lid lifted ; 2, longitudinal section of an unexpanded flower ; 3, front-view of two stamens ; 4, back-view of a stamen ; 5, style and stigma ; 6 and 7, longitudinal and transverse section of fruit ; 8 and 9, fertile and sterile seeds ; 10, embryo in situ ; 11, cotyledons slightly unfolded, laying free part of the radicle ; 12, transverse section of embryo ; 13, portion of a leaf ; all magnified, but to various extent.



Todt del. C.Troedel & Co Lith.

F.v.M. direxit.

Steam Litho Gov Printing Office Melb

Eucalyptus Globulus. *Labillardière.*

Labillardière, relation du voyage à la recherche de La Pérouse i. 153, t. 13 (1799), English translation by Stockdale 111–112, pl. 13 (1800); plantarum Novæ Hollandiæ specimen ii. 121; Sprengel, systema vegetabilium ii. 500; De Candolle, prodromus systematis regni vegetabilis iii. 220; G. Don, general system of dichlamydeous plants ii. 820; D. Dietrich, synopsis plantarum iii. 122; Lindley and Paxton, the Flower-Garden of new and remarkable plants, ii. 38, fig. 153 (1852); J. Hooker, flora Tasmanica i. 133; F. v. M. in Nederlandisk Kruidkundig Archief iv. 140; fragmenta phytographiæ Australiæ ii. 68; plants indigenous to the Colony of Victoria supplemental plate 16; Bentham, flora Australiensis iii. 225; Stewart and Brandis, Forest-Flora of North-West and Central India 231; Bentley and Trimen, medicinal plants, part 15, t. 109 (1876); F. v. M., introduction to botanic teachings p. 7, figs. i.–vi.

The ordinary " Blue Gum-tree " of Victoria and Tasmania.

Finally very tall; branchlets robust, quadrangular; leaves scattered, mostly large, lanceolar-sickleshaped, of thick consistence, of equal color and somewhat shining on both sides, the lateral veins moderately spreading and slightly prominent, but not crowded, the circumferential vein rather distant from the edge of the leaf; oildots mostly concealed; *flowers generally large, axillary, solitary, less frequently two or three together, sessile,* or their common stalk very short broad and compressed; stalklets none; calyx tinged with a bluish-white bloom; *lid depressed-hemispherical, warty-glandular, suddenly raised from the centre to a thick point,* nearly as long as the almost obverse-pyramidal angular warty-glandular tube; stamens all fertile, inflexed before expansion; anthers oblong-oval, opening by parallel longitudinal slits; stigma not or hardly broader than the style; fruit rather large, verging to a hemispheric or obverse-pyramidal form, longitudinally angular, 3- to 5- rarely 6-celled; its *rim broad,* depressed or convex, at the edge separated from the calyx-tube by an ample furrow; valves emergent or convergent, deltoid; seeds all without any appendage, the sterile much narrower than the fertile seeds.

In valleys as well as on ridges and mountain-slopes, chiefly in humid regions of the southern and eastern portions of our colony, from the vicinity of Cape Otway to Wilson's Promontory, northward to the Hume- and Tumut-Rivers in the southern part of New South Wales, occurring also between Braidwood and Araluen, according to the Rev. Rob. Collie, mostly dispersed, but sometimes gregarious, noticed also on the islands of Bass' Straits and frequent in many but particularly the southern parts of Tasmania, not ascending to alpine elevations.

The bark is smooth and greyish- or bluish-white, unless where it may persist at the base of the bole and thus becomes thickened, dark and rough. The general flowerstalks, though usually suppressed, are occasionally extended to ½ inch length. The bracts are connate and fugacious. The anthers are dorsally fixed, turn in a horizontal direction and are somewhat tapering towards the lower extremity. The central point of the lid is conical or blunt. Fruits occur exceptionally of reduced size, and their surrounding furrow is then almost obliterated.

E. cordata, E. diversifolia and perhaps also E. heterophylla of Miquel, as mentioned in the fourth volume of the Kruidkundig Archief, belong to E. globulus.

E. globulus is at once distinguished from all its numerous congeners—except E. alpina—by the warty-glandular calyces, covered by a *crownshaped lid;* besides the shape of its almost or quite sessile fruit is exclusively peculiar and bears resemblance only to that of E. megacarpa and E. Preissiana. The seedlings are of a waxy-powdery somewhat bluish whiteness, have sharply quadrangular stems and sessile heartshaped or cordate-ovate leaves. These characteristics, taken unitedly, offer already marks of discrimination in comparison to E. alpina. The latter is moreover of very slow growth, remains always a shrub, has thicker more shining almost oval or even roundish leaves, smaller flowers, nearly heartshaped anthers, less angular fruits with more

depressed rim ; besides the seeds of the two are visibly different, those of E. alpina being sharply angular, more shining and perceptibly wrinkled-streaked, while most of the sterile seeds are far less narrow ; thus fertile seeds can be easily sifted from sterile seeds of E. globulus, whereas the separation of them in E. alpina would by the sifting process be as difficult as in E. obliqua, E. macrorrhyncha and many other species ; furthermore it will endure such severe frosts, as at once would prove detrimental to E. globulus. The seedlings (and indeed also the young shoots from stumps of stems or their charred remnants) find in form and coloration a repetition in E. tetragona, the whole foliage of which resembles greatly that of the seedlings or young adventitious shoots of E. globulus.

Scarcely any doubt exists, that E. glauca (De Candolle, prodromus iii. 221), to which on De Candolle's authority also E. pulverulenta (Link, enumeratio plantarum horti botanici Berolinensis ii. 31) and E. perfoliata (Noisette in Steudel's nomenclator botanicus, editio prima, 1821) belong, represents the young state of E. globulus, as under the above name plants were cultivated on the continent of Europe many years ago, which, though they had not flowered then, accorded in every respect with the early state of E. globulus, when covered all over with a bluish-white powdery film, the latter occurring likewise on the branchlets and calyces of the advanced tree and giving rise to the somewhat remarkable vernacular name. The author saw such seedlings in the conservatories of the botanic garden of Kiel in 1846, and his university-friend, the Hon. F. Krichauff of Adelaide, who generously presented his whole large collection of dried plants to the writer, preserved in 1847 also in the botanic garden of Berlin specimens of E. glauca, which in no respect can be separated from the seedling-state of E. globulus, and bear besides resemblance only, as above remarked, to the then far less accessible Eucalyptus (Eudesmia) tetragona. But the continued marvellous rapidity of growth of E. globulus, its sanitary importance and the value of its hardwood-timber were then in Middle European conservatories not at all recognized, and it was only in 1852, when I passed through forests of Eucalyptus globulus in Victoria, that I became fully aware of the unparalleled forestral importance of the Blue Gum-tree, and obtained full information on its great utilitarian value, although I received in Adelaide flowering and fruiting branches as early as 1848 from Tasmania.

In the early part of 1853 the author of this work gathered seeds of E. globulus on the base of Mount Buller, where the tree is frequent ; seeds from this locality were transmitted as important to European botanic gardens in the course of that year, and probably from these sendings the first plants arose in Algeria, where now E. globulus is by far the predominant tree. Professor Planchon, who wrote a most able memoir on this tree (in the Revue Deux-mondes 1875) assures us, that E. globulus was raised already during 1854 in Algeria from seeds obtained from the Jardin des Plantes of Paris, and the Montpellier Savant saw flowers in Algeria during his visit in 1863 on trees under the care of Mons. Hardy. Some seeds may have found their way to Europe already much earlier from Hobarton.

Monsieur Prosper Ramel had the fortunate opportunity, to witness the quick growth of this Eucalyptus in the Melbourne botanic garden from 1855 to 1857, though the occasion did never arise to this high-minded gentleman, to notice the tree in its forest-haunts ; only thus he became aware of its quite incalculable value for "reboisement" in countries around the Mediterranean Sea, and to him the merit is due of having, constantly encouraged and advised by myself, on his return to France in 1858 pushed enthusiastically and perseveringly the culture of Eucalyptus globulus on a forestral scale, for which purpose the seeds were largely supplied by myself ; for although the species was cultivated in a few places of South-Europe and perhaps even in Algeria

for mere garden- or park-purposes long before, yet its enormous superiority over nearly or actually all other species of Eucalyptus and indeed any other kinds of hardwood-trees in celerity of growth and general ease of rearing was then not at all appreciated, notwithstanding that Dehnhardt already had raised this Eucalyptus for open-air culture in the earlier part of the century (at least as early as 1829), as proved by an authentic specimen in his collection of dried plants, kindly placed at my disposal for identification of the species by Baron Vincent Cesati, the Director of the botanic garden of Naples*; the tree was named by him E. gigantea, thus must have attained already a large size under his care. It may be incidentally remarked, that two of the most important of all other Eucalypts for cultural purposes, namely E. rostrata and E. amygdalina, were also already in an up-growing state at Dehnhardt's time in the Royal botanic garden of Naples.

It was through His Grace, Dr. J. A. Goold, R. C. Archbishop of Melbourne, that plantations of E. globulus were first established for subduing the miasmatic exhalations of the Pontinian swamps, as mentioned in a letter of this highly distinguished prelate to the author of this work under date of 17th December 1879 : "The Eucalyptus globulus was first raised in the Campagna from seeds, kindly presented to me by you on my visit to Rome in 1869, to attend the Vatican General Council. I handed the seeds to the Superior of the Trappist-Monks, who then occupied the monastery and grounds of the Tre Fontane, a most fever-stricken locality. On my next visit to Rome, made a few years later, I had the pleasure to see the good results of your kind and thoughtful presentation in the vigorous growth of many Gum-trees, acting most wholesomely on poisonous air of that part of the Campagna. The religious able clever men, chiefly French, were most grateful for the gracious gift." Thus through the enlightened circumspectness of our dignified chief of an ancient church the sanitary improvements on the fever-swamps were initiated with prospects of that permanency, for which the plans and works of drainage since the time of Appius Claudius (long before the Christian era) had vainly striven, and in the prosecution of which the overpowering force of nature had baffled the exertions of Julius Cæsar, Trajanus and many of the subsequent rulers of Rome up to recent history.

The degree of resistance of E. globulus against frost depends to some extent, as in the case of many other kinds of trees, on the age of the individual plant, on the moister or drier situation of its growth and also on the greater or lesser shelter against wind. Thus up-grown trees of E. globulus did not suffer at all during the extraordinarily cold winter of 1879–80 at Antibes, when once in December the temperature sunk even as low as 15° F., the trees standing probably in a sheltered position, when E. melliodora and some other congeners lost part of their foliage. Prince Troubetzkoy observed at Lago Maggiore, that E. globulus stood there a cold of 21° F. Drs. Fedeli and Lanzi stated that a temperature of 21° F. only injured the young shoots, and the monks of Tre Fontane, after repeated observation, maintain, that the tree will bear a temperature of 17° F.; all this is in fair consonance with our local experiences here. In the cool elevated but sheltered region, surrounding the alpine height of Mount Buller, I observed snow in large masses to lodge sometimes for protracted periods on the branches of Euc. globulus, eventually injuring even strong limbs, but the stem and main branches remaining unhurt and pushing sprigs and foliage anew in the spring. In the singularly mild clime of the island of Arran, though nearly 56° north, E. globulus survived unscathed the excessively severe winter of 1878–1879, with Acacia decurrens, Dicksonia antarctica, D. squarrosa, Cyathea medullaris, Cordyline

* *See* Nuovo Giornale Botanico Italiano xii. 47.

Australis, C. indivisa, Casuarina quadrivalvis and some other conspicuous plants of Australia and New Zealand, as observed by the Rev. D. Landsborough. Nevertheless E. globulus among tall congeners cannot rival E. pauciflora, E. amygdalina and E. Gunnii in hardiness. Dr. Aberg if he accurately identified the species, found at the mouth of the La Plata-River the following Eucalypts nearly or fully as hardy as E. globulus, and all these also of comparatively rapid growth: E. obliqua, E. Leucoxylon, E. hæmastoma, E. largiflorens, E. longifolia, E. cornuta, E. saligna, E. resinifera, E. corymbosa, E. diversicolor, E. tereticornis and E. rostrata, while E. calophylla, E. marginata, E. maculata and E. macrocarpa perished there from frost; in celerity of growth E. globulus and E. corymbosa carried there the palm, E. diversicolor and E. obliqua coming next. Prof. Goeppert, Dr. Raveret-Wattel and others observed, that E. globulus will bear a severe degree of cold transiently (about 20° F.), if it lasted not sufficiently long to congeal the sap to any great extent, and provided also, that the new wood was well matured and the spot of growth a dry one.

This species produces flowers during our cool season.

The *middle-bark* of E. globulus is without reservoirs of oleo-resin and Kino; the stone-cells are comparatively few, larger than the surrounding parenchyma; small interspersed bast-bundles occur and occasionally cork-cells. The *inner-bark* has the cells of parenchyma very small; the bast-rays are irregular and very narrow; the stone-cells are not observable, but numerous cork-cells occur. Accurate histologic researches on Eucalyptus-barks, commenced on material furnished by me to a leading Austrian Phyto-Anatomist, Dr. Josef Moeller, and now extended here, need yet to be much further continued, before the particular development of the cortical layers, so characteristic for many species, will be fully understood as well in its normal as aberrant phases.

The main anatomic characteristics of the wood are as follows: The vascular tubes on longitudinal sections become apparent as short dark lines or pores, often somewhat twisted; they are isolated, but particularly numerous where the annual layers meet; their lumen is at an average 0·015 m.m. and they are generally filled with cellular substance; their dots are similar to those of many other Eucalypts; the medullary rays are very numerous, consisting of one, two or three rows formed of comparatively ample cells, each filled with a brownish mass; medullary spots none; the parenchyma cells are not numerous, and their walls thin; the wood-fibres are usually curved, their apex is frequently forked, which is one of the causes that the wood is not very fissile; their middle measures about 0·02 m.m. in breadth and their walls are strongly thickened.

The timber of E. globulus is of a rather pale color, hard, heavy, strong and durable, more twisted than that of E. obliqua, E. amygdalina and many other fissile kinds, but not so interlocked as that of E. rostrata, E. melliodora and most of the species termed here Box-trees. Its specific gravity varies from ·698 to 1·108. In transverse strain its strength is about equal to English oak. In durability it occupies a medium position among that of its congeners, being more lasting than that of most so-called White Gum-trees and all Stringybark-trees, but inferior to that of the Red Gum-tree, Ironbark-tree and Box Eucalypts, especially when in contact with the soil or with water. In house-building it is one of our best timbers for joists, studs, rafters or any other heavy scantlings, and is very largely used for this purpose. The Australian Lloyds place the wood of the Blue Gum-tree in the second class of colonial timber, E. rostrata, E. Leucoxylon and E. marginata ranking first. If the different parts of a vessel are constructed of any of the three latter species, it is classed A for twelve years; the following is the number of years assigned to sound wood of E. globulus: for floors of ships, first and second futtocks, main- and rider-keelson, beams and hooks, 10 years; for third futtocks and top-timbers, stem- and stern-posts, transoms,

knightheads, hawse-timbers, apron, deadwood, knees, rudder, windlass, timber- and bilge-strakes and ceiling between, clamps, stringers, shelf-pieces and lower deck-waterways, 9 years ; for light watermark to wales, topsides, sheer-strakes, upper deck-waterways, spirkiting and plank-sheers, 8 years ; keel to first futtock-heads, thence to light watermark, 12 years. The wood of the Blue Gum-tree is also very extensively used by carriage-builders and manufacturers of implements ; for instance, for poles and shafts of light as well as heavy vehicles, for under-carriage work, swivel-trees, spokes and rims, axle-beds, plough-bars, handles of axes, picks, shovels, forks, hoes and hammers and all similar purposes. It is further used for telegraph-poles and for planking for bridges and jetties ; for structures in water and for railway-sleepers it was formerly largely employed, but during the latter years it has given place to the wood of E. rostrata for these purposes. Rural settlers use the Blue Gum wood for fencing, especially for rails, when readily attainable. The Marquis Chateauvieux and Sir George Bowen mentioned to the author, that E. rostrata is reared in such places of Bourbon and Mauritius as are exposed occasionally to violent storms, where E. globulus, though not really fragile, is more apt to break than E. rostrata.

RESULTS of Experiments on the strength of Blue-Gum Timber instituted by Mr. James Mitchell. The pieces subjected to test were 7 feet long by 2 inches square.

—	Deflection.			Total Weight required to break each piece.	Value of Strength $S = \frac{l w}{4 b d^2}$.	Direct cohesion (Tensile Strength) per square inch.	Specific Gravity.
	Weight and Deflection while the Elasticity remained perfect.		Deflection at the crisis of breaking.				
	Weight in—	Deflection in—					
	lbs.	inches.	inches.	lbs.		lbs.	
No. 4, seasoned 8 months ...	294	1·5	7·5	819	2,149	...	1·076
No. 5, seasoned 8 months ...	503	1·375	5·	867	2,276	...	1·034
No. 6, seasoned 2 to 3 years	472	1·375	6·5	1,029	2,701	28,784	1·054
No. 7, seasoned 4 to 5 years	413	1·375	6·	1,043	2,737	27,440	1·078
No. 8, seasoned 2 to 3 years	567	1·75	7·5	1,113	2,921	22,064	·987
No. 9, seasoned 4 to 5 years	434	1·375	6·	1,113	2,921	27,472	1·071
No. 10, seasoned 3 years ...	496	1·625	5·25	1,122	2,945	31,088	·942
No. 15, seasoned 20 years* ...	518	1·625	4·	1,330	3,491	28,336	1·089

* Part of an old door-post.

RESULTS of Experiments instituted by Mr. Laslett on the strength of Blue-Gum Timber. The pieces subjected to trial were 7 feet long by 2 inches square. The weight was suspended in the middle, both ends free.

EXPERIMENTS ON TRANSVERSE STRENGTH.

Number of the Specimen.	Deflections.			Total Weight required to break each piece.	Specific Gravity.
	With the Apparatus weighing 390 lbs.	After the Weight was removed.	At the crisis of breaking.		
	inches.	inches.	inches.	lbs.	
1	1·25	·15	4·50	767	1·079
2	1·75	·20	3·75	602	·997
3	1·35	·10	5·75	710	1·037
4	1·00	·00	3·75	767	1·108
5	1·25	·15	3·50	684	1·026
6	1·00	·00	4·00	741	·924
Average	1·26	·10	4·21	712	1·029

Each piece broke with a short fracture.

S = 1,869.

EUCALYPTUS GLOBULUS.

Experiments on Tensile Strength.

Number of the Specimen.	Dimensions of each piece.	Specific Gravity.	Weight each piece broke with.	Direct cohesion on 1 square inch.
	inches.		lbs.	lbs.
7	2 × 2 × 30	·997	14,560	3,640
8		1·079	26,600	6,650
9		1·037	24,360	6,090
10		1·108	26,600	6,650
11		1·026	28,840	7,210
Average	... ...	1·049	24,192	6,048

Vertical or Crushing Strain on Cubes of 2 inches.

No. 12.	No. 13.	No. 14.	No. 15.	No. 16.	No. 17.	Average.	Average on 1 square inch.
tons.	tons.	tons.	tons.	tons.	tons.	tons.	tons.
12·875	13·000	12·750	11·125	10·500	13·625	12·312	3·078

The tensile strength as given by Jas. Mitchell is greatly in excess of that recorded by Laslett, but is fairly in accord with some recent observations by Mr. F. C. Campbell of Geelong. (*See* Proceedings of the Royal Society of Victoria 1879.)

Results of Experiments on the transverse strength of Wood of Eucalyptus globulus, instituted by Baron von Mueller and J. G. Luehmann. The pieces were 2 inches square, 2 feet long between the supports, the weight suspended in the middle, both ends free. The timber was seasoned for nine months.

No.	Deflection.			Total Weight required to break each piece.	$S = \frac{L\,W}{4\,bd^2}$	Specific Gravity.
	With the Apparatus weighing 780 lbs.	After the Weight was removed.	At the crisis of breaking.			
	inches.	inches.	inches.	lbs.		
1	·12	·04	·75	2,444	1,833	·938
2	·08	nil	·62	3,224	2,418	·992
3	·16	·04	·58	2,256	1,692	·913
4	·12	·04	·75	2,661	1,996	·942
5	·10	·02	·75	2,740	2,055	·946
6	·12	·03	·55	2,288	1,716	·927
7	·12	·02	·75	2,409	1,807	·924
8	·12	·04	·58	2,280	1,710	·845
9	·16	·04	·62	2,252	1,689	·852
10	·05	nil	·58	3,752	2,814	1·094
11	·08	nil	·65	3,024	2,268	1·096

$$S \text{ (strength)} = \frac{L \text{ (length)} \times W \text{ (weight)}}{4 \times b \text{ (breadth)} \times d^2 \text{ (depth multiplied by itself)}}.$$

RESULTS of Experiments on the transverse strength of the Wood of various Eucalypts, by Baron von Mueller and J. G. Luehmann. Specimens 2 feet long, 2 inches square.

—	Deflection.		Total Weight required to break each piece.	Value of Strength $S=\frac{LW}{4\,BD^2}$.	Specific Gravity.	
	With the Apparatus weighing 780 lbs.	At the crisis of breaking.			Air-dried.	Absolutely dried.
	inches.	inches.	pounds.			
Eucalyptus Leucoxylon — Victorian	·03	·63	4,192	3,144	1·028	·908
Ironbark-tree	·03	·60	3,977	2,983	1·061	·913
siderophloia — Sydney Ironbark-	·02	·63	3,873	2,905	1·075	·936
tree	·02	·56	3,752	2,814	1·129	·953
polyanthema—Red Box	·10	·56	3,215	2,411	1·248	1·031
	·08	·58	3,145	2,359	1·214	1·010
melliodora—Yellow Box... ...	·06	·58	2,903	2,177	1·112	·947
	·08	·63	2,781	2,086	1·040	·876
rostrata—Pale Red Gum-tree ...	·08	·52	2,781	2,086	1·008	·843
	·07	·48	2,712	2,034	·940	·790
rostrata—Dark Red Gum-tree ...	·10	·65	2,539	1,904	1·045	·874
	·09	·68	2,417	1,813	·984	·809
macrorrhyncha—Stringybark-tree	·17	·62	2,412	1,809	·952	·809
	·17	·60	2,384	1,788	1·060	·901
Gunnii var.—Swamp Gum-tree ...	·12	·75	2,327	1,745	·950	·802
	·14	·75	2,268	1,701	1·021	·842
Stuartiana — Apple-scented Gum-	·12	·54	2,425	1,819	1·010	·850
tree	·14	·56	2,170	1,627	1·001	·834
viminalis—White Gum-tree ...	·12	·65	2,384	1,788	·954	·797
	·12	·70	2,195	1,646	·916	·761
goniocalyx—Bastard Box ...	·16	·50	2,209	1,658	·948	·807
	·20	·58	2,050	1,537	·937	·798
amygdalina—Peppermint-tree ...	·12	·65	2,195	1,646	1·045	·878
	·12	·70	2,132	1,599	1·076	·908
obliqua—Messmate	·12	·50	2,053	1,540	1·045	·867
	·14	·48	1,776	1,332	·935	·783

RESULTS of Experiments on the transverse strength of Timber other than Eucalyptus, by Baron von Mueller and J. G. Luehmann. Specimens 2 feet long, 2 inches square.

—	Deflection.		Total Weight required to break each piece.	Value of Strength $S=\frac{LW}{4\,BD^2}$.	Specific Gravity.	
	With the Apparatus weighing 780 lbs.	At the crisis of breaking.			Air-dried.	Absolutely dried.
	inches.	inches.	pounds.			
Carya species—Hickory	·04	·60	3,579	2,684	·785	·665
	·05	·56	3,388	2,541	·808	·688
Fraxinus Americana—American White	·12	·54	2,504	1,878	·800	·696
Ash	·12	·54	2,640	1,980	·604	·525
Quercus alba—American White Oak ...	·10	·62	2,781	2,086	·716	·612
	·12	·65	2,192	1,644	·669	·582
Acacia Melanoxylon—Blackwood ...	·08	·50	2,296	1,722	·616	·529
	·08	·54	2,261	1,696	·625	·536
Dammara australis—Kauri	·08	·42	2,053	1,540	·600	·518
	·08	·42	1,967	1,475	·613	·531
Pinus silvestris—Baltic Deal... ...	·17	·70	1,811	1,358	·541	·458
	·21	·48	1,398	1,048	·399	·346

Mr. Laslett obtained for English Oak S = 2,117.

In Chambers Mathematics the following quotations are given for S:—Ash 2,030; Beech 1,560; Birch 1,900; Elm 1,030; Fir 1,100 to 1,140; Larch 1,120; English Oak 1,200 to 2,260; Canadian Oak 1,760; Red Pine 1,340; Poon 2,200; Teak 2,460.

The statements in reference to the specific gravity hitherto given fluctuate between ·698 (Osborne) and 1·108 (Laslett). This great disparity finds its explanation in the different degrees of dryness (natural or artificial) and also in the age and quality of the timber from different localities. To render records of this kind most reliable, the mean of a multitude of observations should be ascertained, and the samples be reduced to an uniform complete dryness. Our experiments here on ordinary samples from timber yards ranged in their results from ·845 to 1·096.

Perhaps not even to the Royal Oak of England has such an extensive literature been devoted at any particular period as to our Blue Gum-tree within the last twenty years. Indeed, if even only the main substance of the writings on this now famous tree, such as appeared during the comparatively short space of time since it came into notice, were to be collected, we should have material enough to fill a large volume. But as the main object of the present work consists in an endeavour to set clearly forth the systematic characteristics of the various Eucalypts, with a view of facilitating the discrimination of the species, it will not be necessary on the present occasion to excerpt extensively from the writings of other observers ; but it may prove of utility to quote the list of publications on Eucalyptus (and chiefly on E. globulus) inserted into the "Bulletin mensuel de la Société d'Acclimatation de Paris," as far as they appeared in that important periodical, an index of which up to 1877 was given already by Dr. Jules Grisard. (*See* Bullet. troisième serie, tome iii. 59–62.) To this list are here now added notes on some more publications, quoted in Bentley's and Trimen's "Medicinal Plants" (Part 15) and many in addition, to which I had access also ; though this index is far from claiming completeness, the scattered literature even of Eucalypts being only very partially to us accessible here.

Aberg, E. Irrigacion y Eucalyptus, Buenos Aires, 1874.
Akhbar (Journal), Culture de l'Eucalyptus en Algérie, 1870.
American Pharmaceutical Association (Proceedings), 1875.
André, E. Euc. globulus, 1863.
Bentley, On the Characters, Properties and Uses of Euc. globulus ; Abstract in Year-book of Pharmacy for 1874.
Bentley and Trimen, Medicinal Plants ; Euc. globulus, 1876.
Bertherand, Dr. E. L. L'Eucalyptus au point de vue de l'hygiène en Algérie, 1876.
Bosisto, Jos., in Australian Medical Journal, 1872.
In Proceedings of the Royal Society of Victoria, 1874 (reprinted in Report of Department of Agriculture, Washington, 1877).
In Pharmaceutical Journal, third series, vol. v., London.
Brown, J. E. Progress Report on Forest-reserves of South Australia, 1879.
Brown, Rob. General Remarks on the Botany of terra australis, 1814.
Brunel, Dr. A. Observations cliniques sur l'Euc. globulus, 1872.
Buton, Gio. l'Eucalitto, Bologna, 1875.
Californian Horticulturist (Journal) ; Miscellaneous Notes on Eucalyptus.
Californian Academy (Proceedings) ; Miscellaneous Notes on Eucalyptus.
Carlotti, Dr. R. De la culture de l'Eucalyptus en Corse, 1866.
Sur l'action thérapeutique et la composition élementaire de l'écorce et de la feuille de l'Euc. globulus, 1869.
Du mauvais air en Corse ; assainissement par l'Eucalyptus, 1869.
L'Euc. globulus, son rang parmi les agents de la Matière Médicale, 1872.
Assainissement des regions chaudes insalubres par l'Eucalyptus, 1875.
L'Eucalyptus en Corse, 1877.

Cloez, Examen chimique des feuilles d'Euc. globulus, 1869.
Etude chimique de l'Eucalyptol, 1870.
Cooper, Ellwood, Forest-Culture and Eucalyptus-trees, 1876 (collection of lectures and essays by Baron von Mueller).
Cordier, Renseignements sur la rapidité de la croissance des Eucalyptus, 1873.
Etude forestière des Eucalyptus, 1874.
L'Eucalyptus en Algérie, 1876.
Cosson, E. Note sur l'acclimatation de l'Euc. globulus, 1875.
Curnow, On Eucalyptus, in the "Lancet," 1876.
Department of Agriculture, Washington. Annual Reports ; Numerous occasional notes.
Faust and Homeyer, On Eucalyptus, in Year-book of Pharmacy, 1874 and 1875.
Fedeli, Gregorio, Sulle proprietà bonificanti et terapeutiche dell' Euc. globulus, 1876.
In Pharmaceutical Journal, vol. vi., 3rd series.
Flückiger and Hanbury, Pharmacographia, 1874.
Gastinel-Bey, Professor, Mémoire sur l'Euc. globulus, 1870.
Gildas, Frère, L'Eucalyptus dans la campagne de Rome, 1875.
Gimbert, Dr. L'Euc. globulus, son importance en agriculture, en hygiène et en médecine, 1870.
Etude sur l'influence des plantations d'Euc. globulus, 1873.
Etude des applications thérapeutiques de l'Eucalyptus globulus (Archives générale de médecine), 1875.
Glover, in Pharmaceutical Journal, vol. vi., 3rd series.
Grisard, Dr. Jules, Noms vulgaires des diverses espèces d'Eucalyptus, 1876.
Gubler, Professor, Sur l'Eucalyptus et son emploi thérapeutique, 1871.
Hamm, Dr. W. von, Der Fieber-Heilbaum oder Blaugummi-Baum, 1878.
Hardy, Lettre sur l'Eucalyptus, 1864.
Henry, R. Note sur une formule pratique pour le cubage des Eucalyptus, 1876.
Homeyer, in Journal of the Chemical Society, 1876.
In Garr. Materia Medica.
Hough, Frankl. B. Report upon Forestry, Washington, 1878.
Journal of Applied Science. Chemical products of the Eucalyptus, 1876.
Kellogg, Dr. A., in the proceedings of the California Academy of Sciences, 1875.
Lambert, E. Eucalyptus, culture, exploitation et production ; son rôle en Algérie, 1872.
Laslett, Thos. Timber and Timber-trees, 1875.
Leingre, Notice sur l'Euc. globulus, 1875.
Lorinser, Dr. In Wiener medicinischen Wochenschrift, vols. xix. and xx. (1869–1870).
Maclean, Dr. In "Practitioner," 1871.
Maillard de Marafy, Comte, L'Eucalyptus, nouvel emploi industriel, 1870.
Maisch, in American Journal of Pharmacy, 1876.
Marès, Dr. P. Note sur l'Eucalyptus, 1870.
Meehan, Professor Th. Different notes in "Gardeners' Monthly," Philadelphia, 1870–1880.
Mérice, E. Progrès et developpement de la culture de l'Eucalyptus, 1874.
Ministère de la marine et des colonies, Paris, Des plantations d'Eucalyptus dans les colonies françaises, 1873.
Mitchell, J. On the strength, durability and value of the timber of the Blue Gum-tree of Tasmania (papers of the Roy. Soc.), 1851.
Moore, Ch. On the woods of New South Wales, in Report on the Intercolonial Exhibition of Sydney, 1870.

Mouchalait, De l'Eucalyptus, 1867.

Mueller, Baron Ferd. von, Reports to the Victorian Parliament, 1853–1874.

On a general introduction of useful plants into Victoria (Transact. Phil. Inst. Vict., vol. ii., 1857).

Report on the resources of Victoria (Transact. Roy. Soc. Vict. 1860).

Victorian (second London) Exhibition ; indigenous vegetable substances, 1862–1863.

Report on the vegetable products of the Intercolonial Exhibition of 1866–67.

Australian vegetation, indigenous or introduced, 1866.

Select Plants, readily available for industrial culture, 1876 ; Indian enlarged edition, 1880.

In Bulletin de la Société d'Agriculture d'Alger, 1868.

Forest-Culture in relation to industrial pursuits, 1871.

On Euc. globulus ; in the Journal of the Agricultural Society of Calcutta, 1874.

In McIvor's Chemistry of Agriculture, 1879.

Nardy, Les Eucalyptus sur le littoral de la Mediterranée, 1875.

Naudin, Ch. In Revue horticole, 1861.

Pasquier, A. De l'Eucalyptus, 1873.

Pharmaceutical Journal, The hygienic influences of the Pine and the Eucalyptus, 1876.

Philippe, Sur l'Euc. globulus, 1862.

Sur l'Euc. globulus et l'Hovenia dulcis, 1864.

Pietra-Santa, Dr. Influence de l'Eucalyptus en Algérie et en Corse (in La Nature), 1877.

Planchon, Professor J. E. L'Euc. globulus au point de vue botanique, economique et médical, 1875 (Revue des deux mondes). Translated into English by the Department of Agriculture, Washington, 1875.

Ramel, Prosper, Sur les Eucalyptus oleosa et globulus, 1861.

L'Euc. globulus (Revue maritime et coloniale), 1862.

Des Eucalyptus, envisagé au point de vue de la production du miel et de la cire, 1864.

Many Notes since 1861, all in the Bulletin de la Soc. d'Acclim. de Paris.

Raveret-Wattel, Dr. L'Eucalyptus, Rapport sur son introduction, sa culture, ses propriétés, usages, etc., 1871.

Revue maritime et coloniale (Journal), L'Eucalyptus globulus de Tasmanie, 1861.

Saint-Hilaire, Geoffroy de, Notes sur le jardin d'acclimatation d'Hyères, 1876.

Salvy, L. Note sur l'Eucalyptus et sur la fabrication de la liqueur faite avec les feuilles de cet arbre, 1871.

Sicard, Dr. A. Sur l'introduction de l'Eucalyptus globulus dans le Department des Bouches du Rhone, 1868.

Simmonds, P. L. Journal of applied Science, 1875–1880, several notices.

Smith, A. In Lindley's and Moore's Treasury of Botany, 1866, 1873 and 1876.

Société d'Acclimatation de Paris, Very numerous notes in the Procèsverbaux from 1861–1880, irrespective of the memoirs separately quoted.

Taylor, Th. On the Chemical Composition of Eucalyptus-leaves, in the Report of the Department of Agriculture of Washington, 1876.

Tenison-Woods, Rev. Jul. E. Tasmanian Forests, their Botany and economical value ; in Journal of the Royal Society of New South Wales, 1879.

Torelli, Comte, L'Eucalyptus e Roma, 1879.

Trottier, Boisement dans le desert et colonisation au moyen de l'Eucalyptus, 1869.

De l'accroissement et de la valeur progressive de l'Eucalyptus, 1871.

Rôle de l'Eucalyptus en Algérie, 1876.

Arbres de l'Australie.

Trottier, Note sur l'Eucalyptus.
Turrel, Dr. Notes sur l'acclimatation de quelques végétaux, 1866.
Ward, General Sir E. M. Timber of New South Wales, its elasticity and strength, 1861.
Woolls, Rev. Dr. W. A Contribution to the Flora of Australia ; the genus Eucalyptus, 1867.
Lectures on the Vegetable Kingdom, 1879.

The following are the results of experiments on Blue Gum wood as regards its yield of potash :—One ton of green timber from the trunk stripped of the bark yielded 1 lb. 5 oz. of pure potash or 2 lbs. 3 oz. of soluble salts, which might be regarded as equal to pearlash ; one ton of dry trunkwood yielded 2 lbs. 11 oz. of pure potash or 4 lbs. 8 oz. soluble salts ; one ton of branches with leaves as lopped off the tree yielded 4 lbs. 12 oz. of pure potash or 8 lbs. 5 oz. of soluble salts. Difference of soil, in which the tree grows, will alter to some extent these proportions.

In the notes on E. megacarpa will be seen, how very different Eucalyptus-seeds of various species turn out in comparative size, and accordingly their weight as a merchandise is also much diversified ; thus one ounce of sifted seeds of E. globulus contains about 10,000 fertile grains. Seeds of this tree kept their vitality at least four years, according to our tests, so far instituted, but perhaps they will keep much longer ; the more minute seed-grains of E. amygdalina germinated here still after six years, whereas the comparatively large seeds of E. miniata proved in our experiments to have retained their power of germination fully thirteen years.

For mitigating the heat of arid tree-less regions, subject to high summer temperature, E. globulus plays a most important part also. But the culture of the tree should be *millionfold,* as effected already by wise statesmanship and enlightened private enterprise in Algeria, Upper India and some of the western states of the North American Union. The rearing of forests of our Blue Gum-tree can be accomplished more cheaply and more easily than that of almost any other tree, while the return is twice or three times earlier than that of the most productive Pine- or Oak-forests ; and this raising of Eucalyptus-forests can be extended to regions, in which most Pines and all Oaks would cope in vain with an almost rainless clime, though Eucalyptus-culture can never advance to cold zones. In a few months seedlings can be raised of sufficient strength, to be set out at the beginning of the cool season, and these will live already through the next summer without bestowal of any particular care. Sterile land, unless it be absolute sand, will soon be transformed into a verdant and salubrious grove, more particularly so if the substrata do not consist of impenetrable layers or outcrops of rocks. While quietly the forest advances, almost without expenditure and care, its wood-treasures increase from year to year without taxing the patience of generations, and within less than half the lifetime of man, timber of conspicuous dimensions can be removed, after fuel had been provided annually long before, while the unpropitious original surface-soil will have been converted into a stratum of fertility for agricultural or pastoral returns from successive storage of mineral aliments brought by the roots of the trees from far beneath, and accumulating through the decay of the dropping foliage. Colonel Playfair, British Consul-General in Algeria, informs me that there on extensive arable lands of his estate, where scarcely the seed-grain of wheat could be reaped in years of drought, the very young Eucalypt suffered in no way. It is not too much to assert, that among rather more than one thousand different species of trees, indigenous in Australia, E. globulus takes the first position in importance, and among its own kinds it is the Prince of Eucalypts.

The first positive experiments upon the febrifugal virtues of leaves of E. globulus were made in Spain by Dr. Tristany, whose observations were published in the Compilador medico, 1865 ; these confirmed the already popular reputation gained by the new remedy in the maritime provinces of that kingdom, where the opportunities for testing the therapeutic value of the leaves most readily arose in cases of ague, from which the native country of E. globulus is so singularly exempt. Dr. Tristany's observations were unexpected, all the more so as the common Cajuput-tree of India (Melaleuca Leucadendron, which not only in natural affinities is closely allied to the Eucalypts, but also yields a medicinal oil of much resemblance to Eucalyptus-oil) was never credited with any anti-pyretic power either by the ancient Indian population or by any of the European physicians, who had there to deal with fever-cases of the worst type during the successive last centuries. The assurances of the Spanish physician incited the late Dr. Adolph Brunel of Toulon, to make E. globulus the subject of grave clinical experiments, which gave affirmative results. Meanwhile and subsequently the researches of Dr. Gimbert of Cannes, Drs. Carlotti and Tedeschi of Corsica, Drs. Marès, Bertherand and Miergnes of Algeria, Professor Gubler, Dr. Leuglet and Dr. Pepin of Paris, Dr. Maclean of Netley, Professor Lorinser of Vienna, Dr. Castan of Montpellier, Dr. Sacchero of Sicily and several other medical practitioners (some early also in the La Plata States) placed the anti-febrile properties of the new medicament beyond a doubt. In the universal exhibitions of Philadelphia, Vienna, the last one of Paris and in that of Sydney, numerous medicinal preparations emanating from Eucalypts have been brought before the world, our fellow-citizen, Mr. Jos. Bosisto, being foremost among those, who have greatly and successfully striven to bring these Eucalyptus-medicines under notice. In the comparatively limited ague-regions of North-East Australia, where Eucalyptus-vegetation is very largely replaced by ordinary jungle-trees of Indian type, travellers and settlers have also found in Eucalyptus-preparations an effectual remedy against the fever. The idea of converting Eucalyptus-leaves into cigarettes arose with Mons. Prosper Ramel, who also turned it first into practice, indeed many years ago.

We have as yet no accurate pathologic data on the effect of the exhalation of Eucalyptus-forests on phthisic patients ; but I anticipate, that in the same manner as the air of dense woods of Pines is apt to stay the inflammatory processes in diseases of the respiratory organs, so the vapors of our Eucalyptus-forests, the odor of which we so readily perceive and recognize, will likewise arrest the progress of these sad diseases, more particularly in their earlier stages, and probably more so than sea-air, notwithstanding its pureness, the atoms of bromine and iodine carried with it and the increased ozone, which it evolves. Indeed I should assume, that sanitarian dwellings could nowhere on the whole earth be provided for phthisic patients more auspiciously and more hopefully, than in mountains clothed with Eucalyptus-forests in extra-tropical Australia and at elevations (varying according to latitude from 1,000 to 3,000 feet), where the slightly rarified air of a very moderate humidity pervaded by Eucalyptus vapor together with the comparative equability of the temperature would ease the respiration greatly. This assumption is largely based on the facts, that no other gregarious trees in the world evolve essential oil so largely as our Eucalypts, unless perhaps some of the most terebinthine Pines of colder climes, and that thus is afforded most copiously an oily volatile emanation, befitted to absorb and condense oxygen into ozone, the most powerfully vitalizing, oxydizing and therefore also chemically and therapeutically disinfecting element in nature's whole range over the globe.

Our Blue Gum-tree has on the whole exercised already on regions of the warm temperate zone a greater influence, scenic, industrial and hygienic, than any other single species of

arboreous vegetation ever reared anywhere, even Pines or Oaks or other classes of leading trees not excepted. Thus it has transformed the features of wide formerly tree-less landscapes, has already afforded in many places timber and fuel for rapidly increasing settlements, and rendered also many a miasmatic locality permanently habitable. The sanitary influence of Eucalyptus-vegetation was surmised by more than one of the early Australian settlers, who however were reluctant to place their conjectures on public record without positive investigations and final proof. Mons. Ramel touched with a few words on this subject (Revue maritime et coloniale) in 1861, but Sir William Macarthur was perhaps the first to argue, very many years ago, that our freedom from ague here was mainly due to our extensive myrtaceous vegetation, in which the Eucalypts are prominent, although species of Melaleuca, Leptospermum, Bæckea and some allied genera are also gregarious in many parts of Australia. The incontestable sanitary effect of these prevailing Myrtaceæ throughout Australia, except in some of the tropical coast-tracts, must be ascribed to a complex of causes: 1st, the ready and copious absorption of humidity from the soil by Eucalypts and closely allied trees; 2ndly, their corresponding power of exhalation, much greater than that of many other kinds of trees; 3rdly, especially the evolution of peculiar highly antiseptic volatile oil; 4thly, the disinfecting action of the dropping foliage on decaying organic matter in the soil, Eucalyptus-leaves themselves not causing any noxious effluvia through their own decomposition. Thus during maceration, for artistic skeletonizing, Eucalyptus-leaves, unlike almost all other kinds of foliage, give off no disagreeable odor, as first observed here by Mrs. Dr. Lewellin. The disinfecting and deodorizing virtue of the tree being unquestionable, it has even been placed in the wards of continental hospitals, a measure initiated by Drs. Mosler and Goeze of Greifswald and here insisted on by Dr. Alexander Buettner. The fresh bruised leaves can with advantage be employed for the dressing of wounds to prevent or subdue septic inflammation, especially when no other remedies are at hand. Possibly the Blue Gum-tree is even a better scavenger of back-yards than a weeping willow, and in so far safer as it does not intrude into the foundations of buildings and leaves no putrefying foliage. Indeed the sewage-question of cities in the warm temperate zone would become very much simplified, if each house had at its rear the evergreen Eucalyptus tree. Mr. Th. Taylor found that albuminous compounds could be preserved in water, which by mere maceration of leaves of E. globulus had absorbed some of their oil and perhaps other preservative particles, a few drops of oil added to water serving the same purpose. Other kinds of volatile oils act very variously in this respect. To Bacteria and other micro-organisms Eucalyptus-oil proves as fatal as Phenic Acid; hence also, as Taylor observed, it may be injected into the veins and arteries of cadavers for purposes of preservation. Flesh of any kind is as well preserved by Eucalyptus-oil as by Creosote, while beef sprinkled with it will dry hard without putrefaction. This writer is inclined to attribute the hygienic action of the oils of Eucalyptus and Pines simply to their high oxydizing power exemplified in the decomposition of miasmata. He recommends Eucalyptus-oil to be applied as an admixture to dressings in Gangrene. (*See* Report of the Department of Agriculture, Washington, 1876, pp. 82–86.)

Senateur Comte Torelli, who has been commissioned to initiate the extensive culture of E. globulus on the malarian swamps near Rome, informs us, that at Gaëta a specimen of this tree among those, planted by Royal order in 1854, was about 100 feet high in 1878, showing a basal circumference of eleven feet. But Dr. W. von Hamm of Vienna, who purposely visited Italy in the interest of Eucalyptus-culture, saw still larger trees at Lago Maggiore, one of which in 1878 was fully 120 feet high, and was supposed to be 28 years old. At Hyères a tree, raised from seed

in 1857, according to Dr. Raveret-Wattel had attained in 1875 a height of 67 feet, with a circumference of seven feet towards the base of the stem. As far north as Nizza a small seedling planted in 1869 had risen in 1874 to a tree of about 50 feet height, with a circumference of three feet of the basal portion of the stem. At Malaga, according to Dr. Planchon, a specimen attained in six years 65 feet. Still greater celerity of growth is shown by E. globulus in temperate regions of tropical mountains, where equality of temperature is combined with moderate continuous humidity. Thus Mr. Brace wrote to me from the Neilgherri-Hills of the Madras Presidency, that his Eucalypts had attained an average height of 20 to 25 feet 18 months after the seeds were sown! Nearly the same wonderfully quick development was noticed in Réunion. Many other instances of the marvellous quickness of growth could be adduced, if it were necessary, as we have witnessed such ourselves as near as the banks of the Yarra of our own city. But the extraordinary rate of growth becomes soon retarded, if the subsoil is not deep and friable; still if such is the case, then the tree will succeed surprisingly even in poor soil, particularly if such is not altogether too dry. Naturally the species is almost restricted to humid valleys of mountainous country or to lower slopes of forest-ranges, though in culture it accommodates itself to most sorts of soil with singular readiness. On the storm-beaten rocks of Wilson's Promontory I have seen it profusely in flower and fruit, though dwarfed by exposure to the size of a mere shrub, when almost within the reach of oceanic spray. The tree is however quite adverse to saline ground, and seems to avoid also soil containing much lime, as noticed likewise by Mons. Lambert in the forest-department of Algeria. As regards the greatest height, which under most favorable circumstances it will attain, it does not fully come up to the stupendous loftiness of E. amygdalina and E. diversicolor, but is one of the very few ranking in this respect next to them in the genus, while under ordinary circumstances it surpasses them all in the early and easy yield of copious fuel and subsequent timber, E. rostrata (with E. tereticornis), E. marginata and perhaps E. siderophloia standing foremost in the lastingness of their wood, E. amygdalina again in hardiness and in the yield of essential oil, E. calophylla with a few other Bloodwood-trees in the flow of Kino-sap, E. microcorys in the copious pervasion of a viscin-like oily fluid throughout its wood, E. rostrata again with E. Gunnii in their fitness for swampy ground, E. hæmastoma for its adaptability for sand-lands. Thus, though nature distributed also in this instance her gifts variously, it placed for the general requirements of mankind E. globulus in the most favored position among this race of highly valuable trees. As regards quick rate of growth it may still be added, that the variety regnans of E. amygdalina surpasses even E. globulus, but only when occurring (as Swamp Gum-tree) in springy forest-glens with deep rich soil. General Sir William Denison seems to have arrived at the conclusion, from observations at Hobarton, that E. globulus will continue its upward growth in deep nutritive soil for about 80 years, after which space of time the tree will only enlarge in the girth of its stem and branches. It is evidently a species of longevity, but the age of 2,300 years allotted as possible for E. globulus (Langethal, Kalender der Pflanzen, pp. 103–104) is evidently vastly overrated, because the less regular intermediate rings between the annual layers of wood, apt to be formed in trees of the zone of evergreen vegetation, are easily mistaken for the results of a year's growth, and the circumference of a stem-base of 130 feet, on which Professor Langethal based his calculation, is so startling, that it cannot be taken as that of a solid stem-barrel, but must have included basal buttresses, however gigantic dimensions the tree is known to attain in deep sheltered and irrigated recesses of forests. Rob. Brown, already at the commencement of this century, saw on D'Entrecasteaux's channel some

stems, which exhibited a girth of 40 feet towards their base. Baron von Humboldt stated the height of E. globulus as 230 feet as extraordinary among the records of tall trees known at his time. The Revd. Th. Ewing actually measured a tree showing a height of 280 feet, and the Revd. James Backhouse, whose accuracy can also be implicitly relied upon, gives in the work on his missionary travels the height of the tallest tree seen by him in Tasmania as even 330 feet. Mr. James Dickinson informs me that at South-Port he noticed a tree of E. globulus far exceeding in girth even the mightiest of E. amygdalina; of this particular tree, a local shipwright declared that it contained as much timber as would fully suffice to build a ninety tons schooner solely from it. The stem of this venerable patriarch of the forests measured about 150 feet to the first limb.

Whether in the comparisons of the tallest trees of the globe we perhaps have lost sight of a fact, that a *fallen* tree of Sequoia (or Wellingtonia or Athrotaxis gigantea) is said to have shown an approximate length of 450 feet, can now after 30 years perhaps no longer be affirmed, unless similar astounding results are again attained in the vast extent of Sequoia- or Athrotaxis-forests only recently rendered accessible in Southern California.

The aboriginal appellation of E. globulus among the Gippsland-tribes is "Ballook," according to Mr. A. W. Howitt.

A chemical analysis of the wood of E. globulus, instituted under the author's direction by Mr. L. Rummel, gave the following results. Air-dried wood contained (irrespective of alkalies, alkaline earths and the ordinary constitutents of the cell-walls):

Hygroscopic water	12·00 per cent.
Matter soluble in boiling water (of which again 74 per cent. were precipitable by neutral acetate of lead, and 38 per cent. by ammoniacal acetate of lead)	3·77 per cent.
Matter soluble in boiling diluted hydrochloric acid	3·30 per cent.
Matter soluble in boiling diluted soda-ley	3·20 per cent.

The precipitate obtained by the neutral acetate of lead from the simply aqueous solution gave as soluble in ether:

1, *Eucalyptus-red*, forming a reddish, tasteless and inodorous powder, scarcely soluble in water, easily in alcohol and ether with yellow, in ammonia-liquid with orange color (the latter solution becoming soon decomposed).

2, *Peculiar xylo-gallic acid*, resembling Eucalypto-Gallic acid, but producing with chloride of iron a greenish tinge, which becomes brown on addition of ammonia.

As not soluble in ether were obtained:

1, Peculiar *xylo-tannic acid*, unless identical with Kino-tannic acid, forming a brown amorphous powder of pure astringent taste; it loses part of its solubility in water after evaporation to dryness; it precipitates glue, the chlorides of tin and iron, the latter with blue color; dissolves in alcohol.

2, *Eucalyptic acid*, being light-brown, amorphous, deliquescent, of a strong and pure acid taste; precipitates chloride of tin, but not glue; produces with chloride of iron a purplish-blue color, which on addition of ammonia changes to red-brown; soluble in alcohol.

The precipitate obtained by the ammoniacal acetate of lead from the simply aqueous solution gave:

1, as soluble in water: *Melitose-like substance*, reducing alkaline tartarate of copper incompletely before, but much better after boiling with diluted sulphuric acid.

2, as soluble in ammonia-liquid: *Eucalyptus-red* in a state of decomposition or some allied substance.

3, as insoluble after drying in water, in ammonia liquid and in acids: *Silica.*

The simply aqueous solution further contained as not precipitable by lead-salts: *Eucalyptin*, soluble in ether; but it showed no saccharine contents nor alkaloids.

The matter soluble in boiling diluted hydrochloric acid consisted of *lime-salts*, while that soluble in boiling diluted soda-ley proved to be:

1, *Silica*, as insoluble in alcohol;

2, *Eucalypto-retic acid*, soluble in alcohol and ether, but not in ammonia-liquid; fusible at about 352° F.; resinous in appearance, without very perceptible odor or taste. Besides as soluble in weak alcohol a brown indifferent substance, possibly a decomposition-product, was obtained.

Our phytochemical qualitative analysis of the leaves of E. globulus gave as results:

Eucalypto-gallic acid, differing from gallic acid already by its easier solubility in cold water (in 34 instead of 100 parts); changed by sublimation into pyro-gallic acid.

Eucalypto-tannic acid, being brown, amorphous, of styptic taste, precipitates glue, is precipitated by the tartrate of antimony and potash and by chloride of iron with dark-green color and by concentrated sulphuric acid, not decomposed on boiling with diluted sulphuric acid.

Eucalyptoic acid, bitter yellowish substance, intermixed with spherical or hexagonal crystals and tablets; turns yellow with ammonia, light-pink with lime-water; reduces alkaline tartrate of copper after boiling with diluted sulphuric acid.

Eucalyptin, light-brown amorphous substance, soft, very bitter, inodorous, soluble in 77 parts of cold water, to a greater extent in hot water, in still greater quantity in alcohol, not precipitable by tannic acid or other re-agents for alkaloids; does not reduce alkaline tartrate of copper on boiling; not affected by cold diluted sulphuric acid or other acids, but evolves on boiling with sulphuric acid a peculiar odor and then the solution becomes turbid.

Gum and Saccharine substance, the latter allied to laeva-glucose and melitose.

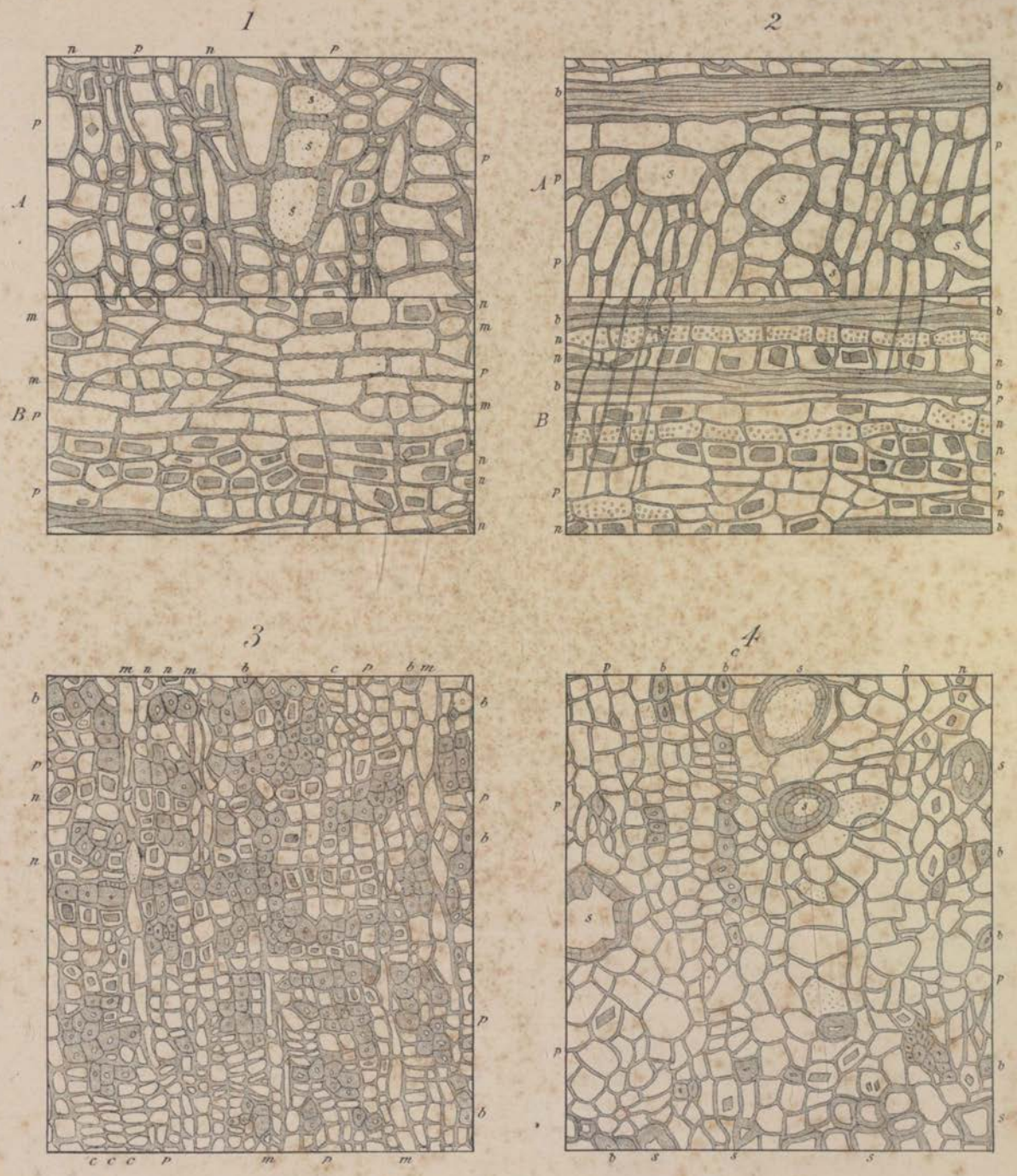
Inorganic Salts.

The volatile oil, which occurs in the leaves of E. globulus, (not fully one per cent.) is here left out of consideration.

Notes on the microscopic anatomy of the leaves, accompanied by a drawing, are given already along with those on E. ptychocarpa in this work.

EXPLANATION OF ANALYTIC DETAILS.—1, outer lid; 2, unexpanded flower, the inner lid lifted; 3, longitudinal section of unexpanded flower; 4 and 5, front- and back-view of anthers with part of their filament; 6, style with stigma; 7 and 8, transverse and longitudinal section of fruit; 9 and 10, fertile and sterile seeds; 11, embryo in situ; 12, embryo uncoiled; 13, transverse section of embryo; all magnified, but to various extent.

ANATOMIC PLATE.—1, tangential section of portion of middle-bark (A) and inner-bark (B); 2, radial section of a portion of middle-bark (A) and inner-bark (B); 3, transverse section of a portion of inner-bark; 4, transverse section of a portion of middle-bark;—*b*, bast-fibre; *c*, cork-cells; *n*, crystal-cells; *m*, medullary rays; *p*, bast-parenchyma; *s*, stone-cells;—diametric augmentation 214 times.



L.Rummel del. C.Troedel & Cº lith. F.v.M. direxit. Steam Litho Gov Printing Office Melb

Eucalyptus globulus. *Labillardière.* 214/1

Todt. del. C. Troedel & Cº Lith. F. v. M. direxit Steam Litho Gov. Printing Office, Melb.

Eucalyptus megacarpa. *F.v.M.*

F. v. M., fragmenta phytographiæ Australiæ ii. 70 (1860); Bentham, flora Australiensis iii. 232; F. v. M., Report on the Forest-resources of Western Australia p. 14.

Finally rather tall; branchlets very angular; leaves scattered, narrow-lanceolar, rarely oval-lanceolar, slightly curved or almost sickleshaped, of equal color and somewhat shining on both sides; *veins very fine*, moderately spreading, the circumferential vein somewhat removed from the edge of the leaf; oil-pores irregular and rather angular; *flowers axillary or lateral, solitary or oftener two or three together, on a conspicuous broadly compressed stalk;* stalklets none; tube of the flowering calyx broadly obconical or topshaped, not much longer than the hemispheric short-pointed lid, both slightly rough; stamens all fertile, inflexed before expansion; anthers oval-oblong, opening with parallel slits; stigma not dilated; *fruits large*, the calycine portion hemispheric, slightly streaked-angular or almost smooth, *the summit turgid, less frequently flat, with* 5 *or sometimes* 4 *or* 6 *thick emersed convergent valves;* rim broad; placental axis wide; seeds very angular, the fertile of nearly the same size as the sterile seeds, all without appendage.

Around Wilson's Inlet and on Mount Elphinstone (Maxwell), thence westward to Cape Leeuwin (Gilbert), also on the granitic summit of Mount Burrabunup and on the crest and declivities of the Stirling's Range (F. v. M.).

A middle-sized or occasionally a small tree, discovered already by Robert Brown in 1802 during Flinders's expedition, about half a century afterwards refound by Drummond and later also by Oldfield, taking in South-Western Australia the name of "Blue Gum-tree." Bark from successive shedding of its thin outer layers smooth, greyish-white or according to Maxwell also salmon-colored. Odor of foliage as well as of fruits pleasant, reminding of that of E. Stuartiana. Leaves mostly not very elongated, rather dark-green; the oil-pores in young leaves pellucid, in older leaves much concealed. Flowers variable in size; their stalk sharply two-edged and upwards dilated. Filaments pale; anthers dorsifixed, oscillating, with a large turgid dorsal gland towards the summit. Fruits measuring not rarely nearly an inch in diameter, hence the specific name. Of the precise value of the timber and any of its peculiarities we have hitherto no record. I saw trees with stems 3 feet in diameter on the Gordon-River and in various places near to that stream.

This species bears in some respects alliance to E. globulus, but it is never of gigantic size, seldom reaching 100 feet in height; the leaves are smaller, of thinner consistence and of a different and more agreeable scent, with more subtle veins; those of young seedlings are stalked also and simply opaque, but not like those of E. globulus powdery bluish-white from waxy exudations, nor does this whiteness occur on the branchlets and calyces of the advanced tree; the flowerstalk is not reduced to extreme shortness or altogether absent, the calyces are neither angular-ridged nor warty-rough, the main-lid is less depressed, the outer lid seems never obvious, the fruits are channelled beneath the rim by a less conspicuous furrow and altogether more smooth though similar in form, but the valves are longer, while the fertile and sterile seeds do not show the inequality of those of E. globulus and are also more angular and shining.

The differences between E. megacarpa and E. Preissiana are still greater; the last-mentioned species is only of shrubby growth, the branchlets are stouter, the leaves are mostly opposite, often approaching to an oval form, of very thick texture and paler hue, with thicker veins, the flowers are not rarely provided with short stalklets, the lid separates from the tube of the calyx by a less

regular or even imperfect dehiscence and is often more blunt, the filaments are yellow, the fruits are semiovate with descending rim and short almost deltoid enclosed valves.

The affinity of E. megacarpa to E. cosmophylla is less close.

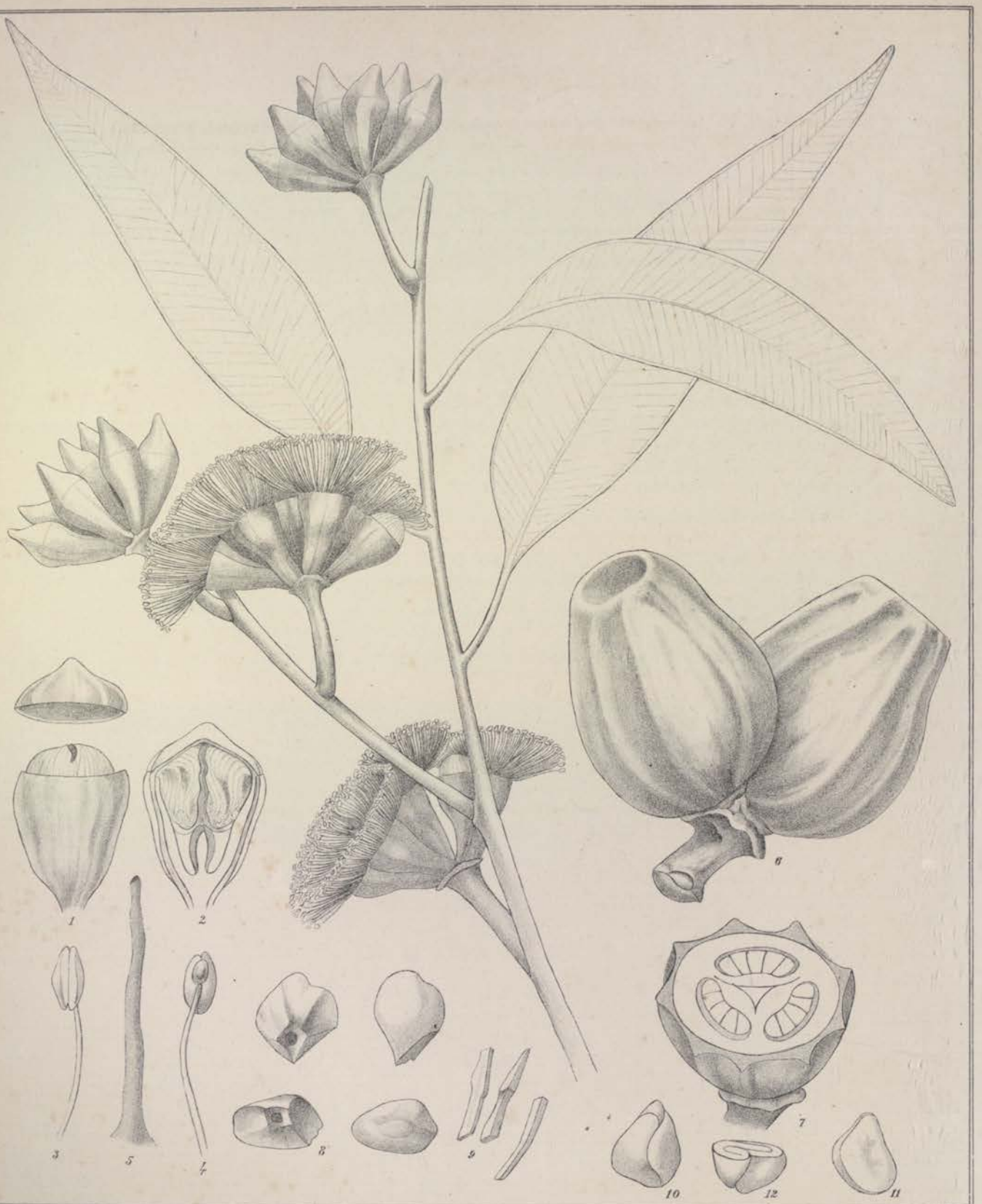
Oil from the fruits proves almost colorless, of odor similar to that of Cajuput-oil, but more agreeable, of 0·872 specific gravity at 75° F., and deflects the plane of polarized light about 10° left. The oil of the foliage is likely to be similar.

The proportionate as well as absolute size of the fertile and sterile seeds is at an average so different in many Eucalypts, as to afford often important marks of specific distinctions. The subjoined notes of measurements may thus aid not only in recognizing species scientifically, but also in controlling to some extent the purchase of seeds of particular kinds in the trade.

Eucalyptus rostrata: fertile seeds $\frac{3}{8}$ to $\frac{1}{2}$ line long, about $\frac{3}{8}$ line broad, sterile seeds $\frac{1}{2}$ to $\frac{3}{4}$ line long, about $\frac{1}{4}$ line broad;—E. polyanthema, E. melliodora, E. paniculata, E. hemiphloia: fertile seeds $\frac{1}{2}$ to $\frac{3}{4}$ line long, about $\frac{1}{2}$ line broad, sterile seeds about $\frac{1}{3}$ line long, $\frac{1}{6}$ to $\frac{1}{4}$ line broad;—E. goniocalyx, E. cornuta, E. Gunnii, E. Stuartiana, E. tereticornis, E. botryoides, E. siderophloia, E. cinerea, E. Leucoxylon: fertile seeds $\frac{3}{4}$ to 1 line long, $\frac{1}{2}$ to $\frac{3}{4}$ line broad, sterile seeds $\frac{1}{2}$ to $\frac{3}{4}$ line long, about $\frac{1}{4}$ line broad;—E. amygdalina: fertile seeds $\frac{2}{3}$ to 1 line long, $\frac{1}{2}$ to $\frac{2}{3}$ line broad, sterile seeds $\frac{1}{2}$ to $\frac{2}{3}$ line long, $\frac{3}{8}$ to $\frac{1}{2}$ line broad;—E. hæmastoma: fertile seeds $\frac{3}{4}$ to 1 line long, about $\frac{3}{4}$ line broad, sterile seeds about $\frac{3}{4}$ line long, $\frac{1}{2}$ line broad;—E. obliqua, E. macrorrhyncha, E. pauciflora, E. Sieberiana: fertile seeds 1 to $1\frac{1}{2}$ lines long, $\frac{3}{4}$ to 1 line broad, sterile seeds $\frac{3}{4}$ to 1 line long, $\frac{1}{2}$ to $\frac{3}{4}$ line broad;—E. cosmophylla: fertile seeds $\frac{3}{4}$ to 1 line long, about $\frac{3}{4}$ line broad, sterile seeds $\frac{3}{4}$ to $1\frac{1}{2}$ lines long, $\frac{1}{3}$ line broad;—E. gomphocephala: fertile seeds 1 to $1\frac{1}{2}$ lines long, $\frac{3}{4}$ to 1 line broad, sterile seeds 1 to $1\frac{1}{2}$ lines long, $\frac{1}{3}$ to $\frac{1}{2}$ line broad;—E. globulus: fertile seeds 1 to $1\frac{1}{2}$ lines long, $\frac{3}{4}$ to 1 line broad, sterile seeds 1 to $1\frac{1}{2}$ lines long, about $\frac{1}{3}$ line broad;—E. megacarpa: fertile seeds 1 to $1\frac{1}{2}$ lines long, $\frac{3}{4}$ to 1 line broad, sterile seeds 1 to $1\frac{1}{2}$ lines long, $\frac{1}{2}$ to $\frac{3}{4}$ lines broad;—E. marginata, E. buprestium: fertile seeds 2 to 3 lines long, 1 to 2 lines broad, sterile seeds $1\frac{1}{4}$ to 2 lines long, $\frac{3}{4}$ to $1\frac{1}{4}$ lines broad;—E. Abergiana: fertile seeds with their membraneous appendage $3\frac{1}{2}$ to 5 lines long, $1\frac{1}{2}$ to 2 lines broad, sterile seeds $1\frac{1}{2}$ to 3 lines long, $\frac{1}{2}$ to $\frac{2}{3}$ line broad;—E. calophylla: fertile seeds 6 to 9 lines long, 3 to 4 lines broad, sterile seeds $2\frac{1}{2}$ to 4 lines long, 1 to $1\frac{1}{2}$ lines broad.

These measurements were instituted at my request by Mr. G. Luehmann, who ably aided me in many of the preliminaries for the elaboration of this Eucalyptography, so especially in the arrangement of the vast additional museum-material of this genus, accumulated since the third volume of the Flora Australiensis appeared, fully fourteen years ago.

EXPLANATION OF ANALYTIC DETAILS.—1, a small-flowered umbel; 2, an unexpanded flower, with its lid lifted; 3, longitudinal section of an unexpanded flower; 4, some outer stamens in situ; 5 and 6, front- and back-view of an anther, with part of its filament; 7, style and stigma; 8 and 9, transverse and longitudinal section of a fruit; 10 and 11, sterile and fertile seeds; 12, embryo in situ; 13, cotyledons partly spread out, to exhibit the radicle; 14, transverse section of embryo;—1, natural size; 2–14, variously magnified.



Tndt del. C. Troedel & Cº Lith. F.v.M. direxit. Steam Litho Gov. Printing Office, Melb.

Eucalyptus miniata. *Cunningham.*

EUCALYPTUS MINIATA. 54

Cunningham, in Walpers repertorium botanices systematicæ ii. 925 (1843); F. v. M., fragmenta phytographiæ Australiæ xi. 42; Bentham, flora Australiensis iii. 228; E. aurantiaca, F. v. M. in the Journal of the Proceedings of the Linnean Society iii. 91.

Finally tall; *branchlets with flowerstalks and calyces often covered with a whitish bloom;* leaves scattered, of rather thin consistence, oblique-lanceolar or somewhat sickleshaped, rarely almost oval, not shining on either side, slightly paler beneath; their lateral veins very subtle, pennately spreading and rather copious, the circumferential vein slightly or hardly removed from the edge of the leaf; oil-dots numerous, but very minute and much concealed; umbels axillary or lateral, solitary, on thick cylindrical or somewhat compressed stalks, bearing 5 to 7 flowers; stalklets none or exceedingly short; *calyx furrowed or streaked* with several longitudinal prominent angles, the tube topshaped or obconical and upwards dilated, slightly or doubly longer than the pyramidal- or blunt-hemispheric lid; stamens all fertile, inflexed before expansion, *filaments orange-colored,* anthers ellipsoid-oval with dorsally broadish connective, opening with parallel slits; style nearly as long as the stamens; stigma not dilated; *fruit very large, oval-urnshaped, ridged by* 8 *to* 10 *primary prominent angles,* 3- to 4-celled; valves short, deeply enclosed; *fertile seeds large,* without any appendicular membrane; sterile seeds comparatively small and partly very narrow.

From the Palmer-River (T. Gulliver) and Lynd-River (Leichhardt) around the Gulf of Carpentaria to Arnhem's Land, reaching the Victoria-River (F. v. M.) and Port Darwin (Schultz), extending westward to York-Sound (Cunningham), occurring on somewhat sandy scrub-lands and also on stony ridges and table-lands.

A tree, attaining a height of 70 feet and perhaps more; stem-diameter known to reach 2 feet. Persistent portion of the bark lamellar, brittle, partly glittering, interwoven with woody ramifications, grey-brownish or yellowish outside, covering the stem but not the branches, the bark of the latter being outside smooth and whitish. Branchlets not manifestly angular and rather thin. Leaves varying in length from 2 to 5 inches and in breadth from $\frac{1}{2}$ to $1\frac{1}{2}$ inches. Flowerstalks stout, $\frac{2}{3}$ to $1\frac{1}{3}$ inches long. Calyces measuring from 5 to 10 lines in length, when ready to burst into flower. Fruits attaining a length of 2 inches, more or less wrinkled between the primary angles. Fertile seeds $2\frac{1}{2}$ to 4 lines long, angular and often truncated, convex on the outer face, edged around the large circular hilum, thence radiating-streaked to the acute margin of the seed; testa neither much shining nor distinctly reticulated; sterile seeds 1 to $1\frac{1}{2}$ lines long, mostly only between $\frac{1}{8}$ and $\frac{2}{3}$ line broad.

In habit E. miniata approaches nearest to E. phœnicea, whose companion it is in Arnhem's Land and around the Gulf of Carpentaria, agreeing with it much in its laminated, friable, easily separable bark, which is however not persistent on the main branches, also more grey and less brown-yellowish outside; it accords furthermore with E. phœnicea in the brilliancy of its flowers, thus forming quite an ornament in the landscape, the name of the species being derived from the color of the filaments like that of red lead. The bark contains more woody ramifications than that of E. phœnicea, but likewise reminds in external appearance and in fracture much of mica-schist, thus indicating for both these trees in the cortical system a peculiar section, that of the Lepidophloiæ, to which also E. peltata belongs. E. miniata differs from E. phœnicea in taller stature, in its branchlets, flowerstalks and calyces being tinged with a whitish bloom, in generally broader leaves with less stomata above than below, in umbels with less flowers, in the absence of

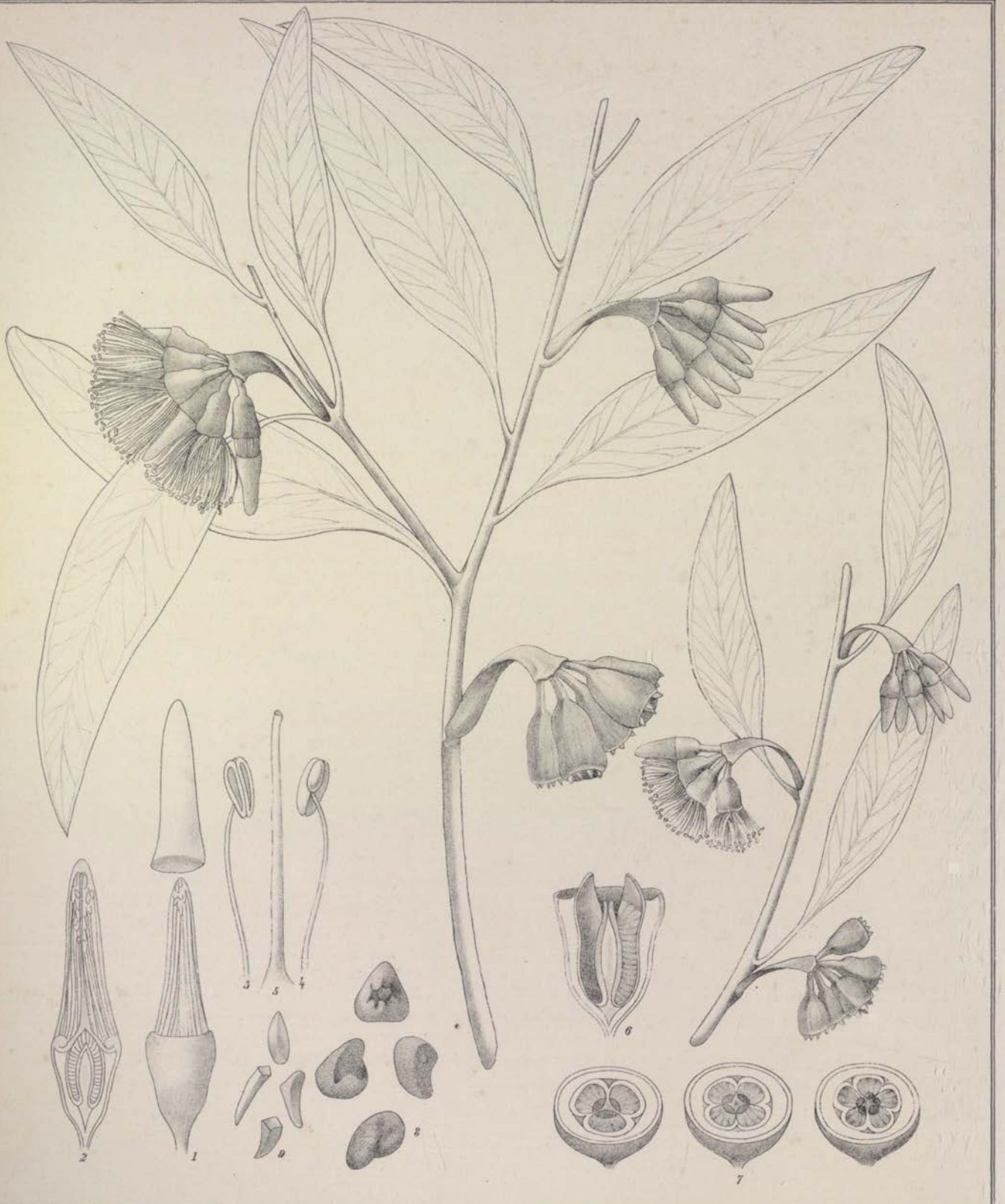
distinct stalklets, in very angular and broader calyces, proportionately longer lid, in more saturated orange-colored filaments, longer anthers, larger very woody fruits, which latter are lined with prominent ridges and open with 3 or 4 valves ; the fertile seeds are also larger.

In its fruit E. miniata resembles E. ptychocarpa very much, but the bark of the latter is more stringy, more solid and on the main-branches persistent, its leaves are of darker color above, of larger size and thicker substance, still less perceptibly dotted by oil-pores, more copiously and more prominently veined and devoid of stomata on the upper surface; the umbels are somewhat paniculated and terminal, the calyces are provided with stalklets; the fruits are not quite so large, while the fertile seeds are terminated by a conspicuous membrane.

E. miniata ought to be introduced along with E. ficifolia, E. phœnicea and E. ptychocarpa into ornamental arboreta, and may even prove useful as a timber-tree. In all likelihood it could be grown anywhere in regions free of frost, though situated far extratropical. Schauer's description of E. miniata was so brief, that it led me formerly to seek Cunningham's species in E. phœnicea. I am aware, that E. miniata produces its blossoms from the month of May to August, and perhaps its flowering time lasts still longer, in which respects this species as well as E. phœnicea has so far the advantage over the gorgeous E. ficifolia, the flowering period of which is limited to very few weeks.

Mr. William Elliott, one of our most experienced and accomplished horticulturists, has very recently raised this Eucalyptus from seeds, taken from specimens in my museum, gathered thirteen years ago. By this experiment it has now been proved, that seeds of Eucalypts will retain their power of germination for a very lengthened period, provided they are stored in a dry and cool locality. This fact adds now another instance to the many recorded in reference to the value of the great genus Eucalyptus, which in its extent and in its importance vies even with such large genera of leading timber-trees as those of Pinus and Quercus, while it surpasses both in tractability under growth as well as in early return of timber, and certainly stands foremost as a genus of forest-trees in the rich complex of its specific forms and in their extensive utilitarian application anywhere among indigenous trees within the whole British dominions!

Explanation of Analytic Details.—1, unexpanded flower, with the lid lifted; 2, longitudinal section of an unexpanded flower; 3 and 4, front- and back-view of an anther with portion of the filament; 5, style and stigma; 6, two ripe fruits; 7, transverse section of a fruit; 8, fertile seeds; 9, sterile seeds; 10, embryo in situ; 11, side-view of cotyledons; 12, transverse section of embryo; all except figs. 6 and 7 magnified, but to various extent.



Todd del: C. Troedel & Cº Lith. F.v.M. direxit. Steam Litho Gov. Printing Office, Melb.

Eucalyptus occidentalis. *Endlicher.*

Endlicher, in Huegel enumeratio plantarum Novæ Hollandiæ austro-occidentalis 49 (1837); Schauer, in Lehmann plantæ Preissianæ i. 128; F. v. M., fragmenta phytographiæ Australiæ ii. 39; Bentham, flora Australiensis iii. 235.

The flat-topped "Yate."

Finally tall; leaves scattered, oval- or oftener sickleshaped-lanceolar, of thick consistence and of equal color on both sides; their lateral veins neither prominent nor crowded, moderately spreading, the circumferential vein somewhat distant from the edge; oil-dots much concealed; *umbel-stalks compressed*, sometimes dilated, axillary or lateral, solitary, rarely a few terminally joined, bearing from 3 to 12 flowers; stalklets angular, about as long as the calyx-tube or variously shorter; *lid cylindric-conical*, about twice as long as the obconic-bellshaped tube of the calyx; stamens all fertile; *filaments yellowish, straight while in bud*, rather rigid; anthers ellipsoid, opening in longitudinal slits; style about as long as the stamens; stigma slightly dilated; fruits obovate-bellshaped or truncate-pearshaped, 4-, rarely 3- or 5-celled, not conspicuously angular, but somewhat streaked; their rim rather narrow, finally prominent; *valves about half-exserted, awlshaped-pointed*, free; seeds without appendage, the sterile seeds numerous, very small, but comparatively not very narrow.

From the Tone-River to regions inland near Cape Le Grand and the Broken Ranges near Orleans-Bay (Maxwell), forming part of the scrubs, known to extend about 40 miles northward of Edicup (Muir) and to ascend high up to the Stirling's Range (F. v. M.), occurring on clayey as well as on sandy soil, also occupying wet places.

In the shrubby state several stems originate from one root, but they may attain 20 feet in height; in favorable localities, such as sheltered valleys with better soil and on banks of streams, a tree rising to 120 feet, and (according to my observations in the Melbourne botanic garden) of rapid growth. Stem of aged trees to a considerable extent smooth, the outer rough more corky and somewhat fibrous portion delapsing in thin hard pieces partially. Limbs smooth and whitish, more erect than spreading, giving a compact head of foliage to the tree, the branches terminating at not very unequal height, by which means the tree assumes a flat-topped appearance and gets an almost funnelshaped outline. Bark of twigs reddish-brown. Heart-wood dark, the other portion of the wood pale. Branchlets slightly or strongly angular. Leaves sometimes almost equilateral, more or less shining on both pages, rarely only about 1½ inches long, the veins in the broader forms of leaves more spreading. Umbel-stalks often recurved, particularly so in age, attaining sometimes a length of fully 1 inch, but usually shorter, though never very short. Lid with the exception of the base mostly narrower than the tube of the calyx. Stamens often less numerous than those of many other species; filaments also thicker than those of very many other congeners, rather bristly than capillary, from ¼ to ¾ inch long, angular, dotted with oil-glands, suddenly terminated in a pointed apex, sometimes seemingly almost orange-colored. Anthers fixed above their base; connective dorsally rather broad, glandular-turgid towards the summit beneath. Style slender. Capsular vertex of the fruit pyramidal-hemispherical; valves sometimes abbreviated. Fertile seeds few, about ⅔ line long; testa from fine streaks and minute dots densely reticulated.

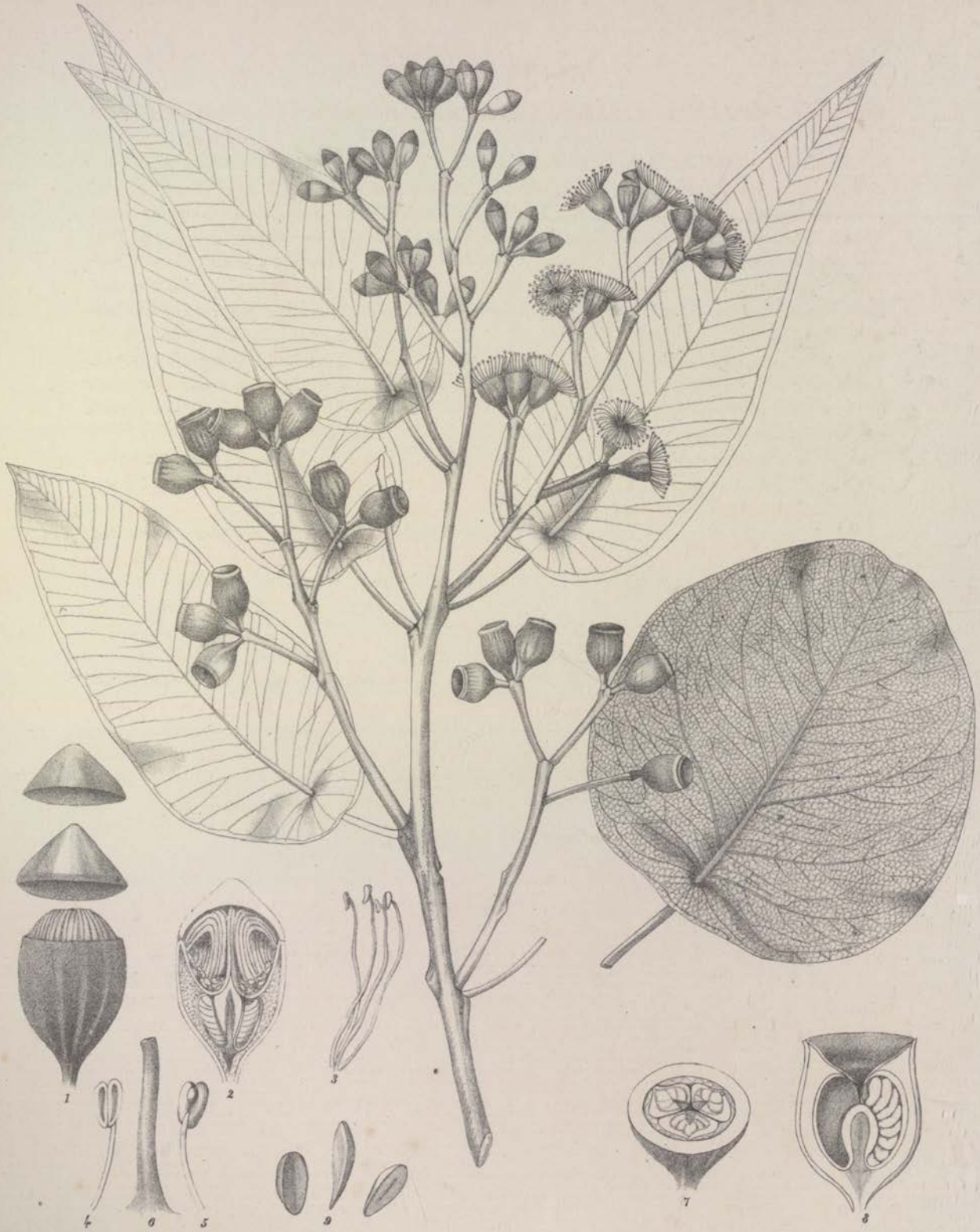
The timber is hard and strong, thus sought by wheelwrights (Th. Muir), and probably as valuable as that of E. cornuta (the ordinary "Yate"). Oldfield records this species as flowering already when only 3–4 feet high on sand-ridges, but where probably the bushes were previously

burnt to the root. It is in blossom during many months, if not perhaps at all seasons; in our collections we have flowering specimens gathered from June to February. Small seedlings have a smooth stem, scattered oval or somewhat rhomboid leaves on short stalks and measuring 1 to 1½ inches in length. (*Vide* F. v. M. fragmenta vii. 43.)

Extended observations on increased material seem to teach us now, that E. spathulata (Hooker, icones plantarum t. 611) and E. macrandra (F. v. M., in Bentham's flora Australiensis iii. 235) are extreme forms of E. occidentalis, the former being distinguished chiefly by small flowers and short and extremely narrow leaves; the other exhibits elongated calyces on hardly any stalklets with very long stamens, generally smaller fruits with very short fruit-valves. More important are the distinctions of E. cornuta and E. obcordata, which with E. occidentalis seem to be the only three entitled to specific rank in the series of Cornutæ or Orthostemoneæ, and even the lines of demarcation between these three are not always very clear; still E. cornuta (lately illustrated in my Report on the Forest-resources of Western Australia pl. 7, and including as varieties E. Lehmanni and E. annulata) differs in the fruits, which without intervention of stalklets are sessile on the common stalk, further in the coherent and exceedingly long fruit-valves, which form thus an awlshaped beak; E. obcordata is distinguished from E. occidentalis by its roundish somewhat crenulated leaves, by the still broader and often longer general flowerstalks, also by the absence of stalklets, by the angular calyx-tube, the often dark-red filaments and fruits with deltoid only short-acuminated valves. E. occidentalis bears likewise some resemblance to E. redunca, notwithstanding the sectionally different position of the two species in the anthereal system; but the bark of E. redunca is altogether smooth and imparts on friction of its surface a white coloration, the flowers are smaller and seated on shorter stalklets, the lid is acutely pointed, proportionately shorter and contracted gradually from a not dilated base, the filaments are thinner, shorter, less angular, more whitish and inflexed while in bud; the fruits are smaller and slightly contracted at the orifice, while their valves are more enclosed, the fertile seeds are smaller and their testa of lighter color and smooth. E. grossa is removed from E. occidentalis by generally broader and thicker leaves, shorter and stouter flowerstalks, absence of stalklets, proportionate shortness of the calyx-lid, filaments inflexed in their earliest state and of less rigidity, and entirely enclosed fruit-valves. It may however here be observed, that the inflexion of the filaments is not an absolute specific character, as they accommodate themselves in E. tereticornis according to the length of the operculum, being quite straight in bud when the lid is so much elongated as to afford them full space. Some shrubby specimens of E. occidentalis, verging to E. obcordata but being narrow-leaved, were placed by Bentham doubtfully with E. grossa. All these Eucalypts belong to the same geographic range.

E. occidentalis, in its scope as here considered, seems so variable, as to change much of former ideas as regards the precincts of Eucalyptus-species, a similar playfulness of forms having been observed by me in E. stricta and E. incrassata, the characters of shrubby Eucalypts proving generally less constant, than those of the tall timber-trees of this genus.

EXPLANATION OF ANALYTIC DETAILS.—1, an unexpanded flower, its lid lifted; 2, longitudinal section of an unexpanded flower; 3–4, front- and back-view of a stamen; 5, style and stigma; 6 and 7, longitudinal and transverse section of fruits; 8 and 9, fertile and sterile seeds; all magnified, but to various extent.



Todt. del. C. Troedel & Cº Lith.

F.v.M. direxit.

Steam Litho Gov. Printing Office, Melb.

Eucalyptus peltata. *Bentham.*

EUCALYPTUS PELTATA. 56

Bentham, flora Australiensis iii. 254 (1866).

Arboreous; *branchlets and leafstalks rough* from very minute partly bristly projections; *leaves mostly inserted above their rounded base*, scattered, of firm consistence, lanceolar- or roundish-oval, of equal and rather pale color on both sides, not or hardly shining; their lateral veins prominent, pennately spreading, but not of close approach, the circumferential vein somewhat removed from the margin; oil-dots copious, but subtle and much concealed; panicles terminal and axillary; umbels generally 5–7-flowered, on rather slender and somewhat angular stalks; *stalklets very short or none; lid double*, pyramidal-hemispheric, about as long as the semi-ovate or truncate-ovate faintly angular tube of the calyx or to doubly shorter, the inner lid shining, the outer hardly or slowly separating; stamens all fertile, inflexed before expansion; anthers oblong-oval, opening by parallel slits; stigma not dilated; fruits rather small, semiovate, slightly constricted below the summit, mostly 3-celled; rim narrow, prominent; valves deltoid, quite enclosed; seeds without any appendage.

On porphyritic mountains at the sources of the Burdekin-, Lynd- and Gilbert-Rivers (F. v. M.); on granite-hills near Charters-Towers in the auriferous formation (Revd. Jul. Tenison-Woods); at Ravenswood near the Burdekin-River (S. Johnson).

A small or middle-sized tree, with a straight trunk seldom above 15 feet long or more than 18 inches in diameter, with a spreading rather dense top (Johnson); foliage drooping, the greatest height of the whole tree about 30 feet (Tenison-Woods). Bark everywhere persistent, lamellar, very brittle, somewhat shining and brownish- or pale-yellowish, the color of the bark having originated the curious vernacular of "Yellow-jacket" for this tree. Wood valued by artisans for various purposes, but seemingly nowhere extensively available. Leaves of also the aged tree fixed above their base (in the manner of the leaves of seedlings or young saplings of E. calophylla and E. citriodora), though on specimens of our collections occasionally a leaf occurs with basal insertion; their length and still more so their width variable; when dry they are not very odorous; their midrib and some of the lateral nerves more or less rough. General flowerstalks often rough, but the umbels and their ultimate stalks smooth. Flowers comparatively small. Tube of the calyces as well as the umbel-stalks not rarely covered with a whitish bloom. Lids always brown, shining, smooth. Fruits verging somewhat to a bellshaped form. Angles of the placentas prominent. Ripe fertile seeds have not yet come under observation.

In many of its characteristics, especially the form of its fruits, E. peltata approaches to E. latifolia, but the latter is smooth-barked, its leaves are partly almost opposite and always attenuated with an acute base into their stalk, the lateral veins less prominent, the reticulations of the veinlets also less visible, while the marginal vein is almost confluent with the edge of the leaves, the stalklets of the flowers are of conspicuous length, the lid is single and separates by a less regularly marked dehiscence, and the brownish roughness of the branchlets and foliage is absent, in which latter respects an approach of E. peltata to E. ferruginea, E. aspera, E. setosa and E. clavigera is established.

Perhaps E. peltata will require to be placed nearest to E. Torelliana, although the latter stands on record as one of the tallest forest-trees near Rockingham-Bay, with a "bark smooth as glass"; moreover the hairiness of its branchlets and leaf-stalks is more conspicuous, all its leaves are of completely basal insertion and evidently paler beneath, therefore their stomata are not isogenous, but—as tabulated before—heterogenous; the flowers and fruits may also prove

different, the former being only as yet known in an unexpanded state and the latter having never yet been collected at all.

The very short descriptive phrase, given from mere leaves, of E. melissiodora in Mitchell's Tropical Australia, p. 235, led me at first to assume (Journal of the Linnean Society iii. 95), that it was the species here now more fully described, which Lindley had before him; but a comparison of the specimen, imperfect as it is, in Sir Thomas Mitchell's collection, suggested to Mr. Bentham, that E. melissiodora might merely constitute the young state of E. citriodora, and this has since been confirmed through local observation by Dr. E. Wuth, whose attention I directed to this subject. In dealing with E. maculata in this work and then reducing, in concurrence with Mr. Bailey, both E. citriodora and melissiodora to that species as varieties, also E. peltata was by a writing error added to the synonyms. It is however well marked, as noticed by myself already in 1856 on the sources of the south-eastern rivers of Carpentaria, by the remarkable texture and structure of the bark, in which respect it bears resemblance only to E. phœnicea and E. miniata, constituting with them the section of Lepidophloiæ in the cortical system. (*See* Journal of the Linnean Society iii. 101.)

E. peltata seems to be the only species of this extensive genus, which in an adult state has leaves with suprabasal insertion. The appellation "Yellow Jacket" is not solely applied to this species, but also to E. ochrophloia.

Explanation of Analytic Details.—1, unexpanded flower, outer and inner lid lifted; 2, longitudinal section of an unexpanded flower; 3, some stamens in situ; 4 and 5, front- and back-view of an anther, with portion of its filament; 6, style and stigma; 7 and 8, transverse and longitudinal section of a fruit; 9, sterile seeds; all magnified, but to various extent.

Todt del. C.Troedel & Co Lith. F.v.M. direxit. Steam Litho. Gov. Printing Office Melb.

Eucalyptus punctata. *De Candolle.*

De Candolle, prodromus systematis naturâlis regni vegetabilis iii. 217 (1828); Mémoire sur la famille des myrtacées t. 4; E. Stuartiana, var. longifolia, Bentham, flora Australiensis iii. 244 partly.

Finally tall; branchlets robust and very angular; *leaves* scattered, elongate- or sickleshaped-lanceolar, of thin consistence, *beneath slightly paler and there not shining;* the lateral veins numerous, very subtle and much spreading, the circumferential vein close to the edge; oil-dots numerous, imperfectly transparent; umbels axillary and solitary or at the summit of the branchlets paniculated; their *stalks broad and strongly compressed,* bearing generally from 3 to 10 flowers; tube of the calyx almost semiovate or nearly hemispherical, merging gradually into an angular rather thick stalklet of about the same or greater or lesser length; *lid semiovate-conical,* as long as the tube or somewhat longer; stamens all fertile, inflexed before expansion; anthers almost oblong, but upwards broader, opening with longitudinal parallel slits; stigma not or hardly broader than the style; fruit nearly semiovate, 3- or oftener 4- rarely 5-celled, not large nor angular, *rim finally rather broadish, flat or convex; valves short, deltoid, at last exserted* or convergent from the rim; seeds all without appendage, the sterile seeds much smaller, but mostly not very narrow.

Known from the vicinity of Port Jackson to the lower portion of the Blue Mountains and to Berrima (Woolls), thence to the McLeay-River; but the precise southern and northern range of this species as yet unascertained.

A tree with the spreading habit of E. tereticornis, growing mostly in dry and rocky places, attaining a height of 100 feet or even more, called "Leather-jacket" by the colonists and also "Hickory-Eucalypt." The aged bark becomes rough and dark, but most of the outer bark is not persistent, hence the Revd. Dr. Woolls places this species now in the series of Leiophloiæ (Lectures on the Vegetable Kingdom 118), but kept it formerly among the Hemiphloiæ. The wood is tough, pale reddish-brown, extremely durable, hard, close-grained, difficult to split, and in use for fence-posts, railway-sleepers, wheelwrights' work and many rough building-purposes even in naval architecture; it is durable under ground, though not equal in value to the wood of Ironbark-trees; it affords also superior fuel.

Leaves exceptionally verging into an oval form, their upper page of a slightly oily lustre. Flowers occasionally only two together. Umbel stalks 3–10 lines long. Lid generally shining and smooth. Lower portion of filaments flexuous before expansion. Anthers versatile, dorsifixed. Style flexuous. Fruits exceptionally devoid of stalklets; rim of the young fruit narrow. Seedlings, according to Dr. Woolls, smooth with slender stems, mostly scattered leaves, the latter elongate- or narrow-lanceolar, paler beneath, their stalks short but distinctly developed.

This tree exudes a reddish Kino. It flowers from March till June. The foliage produces occasionally Melitose-Manna. The "Leather-jacket," included by Bentham in E. resinifera, is E. punctata; it differs from the former in its extensively smooth not fibrous bark, less deep-colored wood, rather thinner leaves, more visible oil-dots, partially paniculated flowers, shorter and less attenuated lid, more depressed fruit-rim and shorter and less pointed valves. E. punctata verges also very close to E. saligna, from which it is best kept apart by its darker colored bark of less smoothness and more leathery texture, its greater tendency to a paniculate inflorescence, larger stalklets, more elongated lid and broader fruit-rim. From E. Stuartiana it is widely distant already in its leaves not of equal color on both sides with a different venation, besides in

its thick and angular branchlets, paniculated upper umbels, broad umbel-stalks, usually longer stalklets, longer lids and also the nature of the bark.

The transparent dots of the leaves, from which the specific appellation was derived, come only well into view after the drying of the foliage.

The curious vernacular name arose from the tough leathery bark, usually darker than that of E. tereticornis and E. rostrata and other species with almost whitish bark. Dr. Woolls believes, that the Brown-barked Gum-tree of New England, mentioned by Mr. Christie, belongs to E. punctata. The foliage ought to yield a fair quantity of volatile oil, which may prove peculiar. The stomata occur only on the lower page of the leaves and number about 140,000 on a square inch.

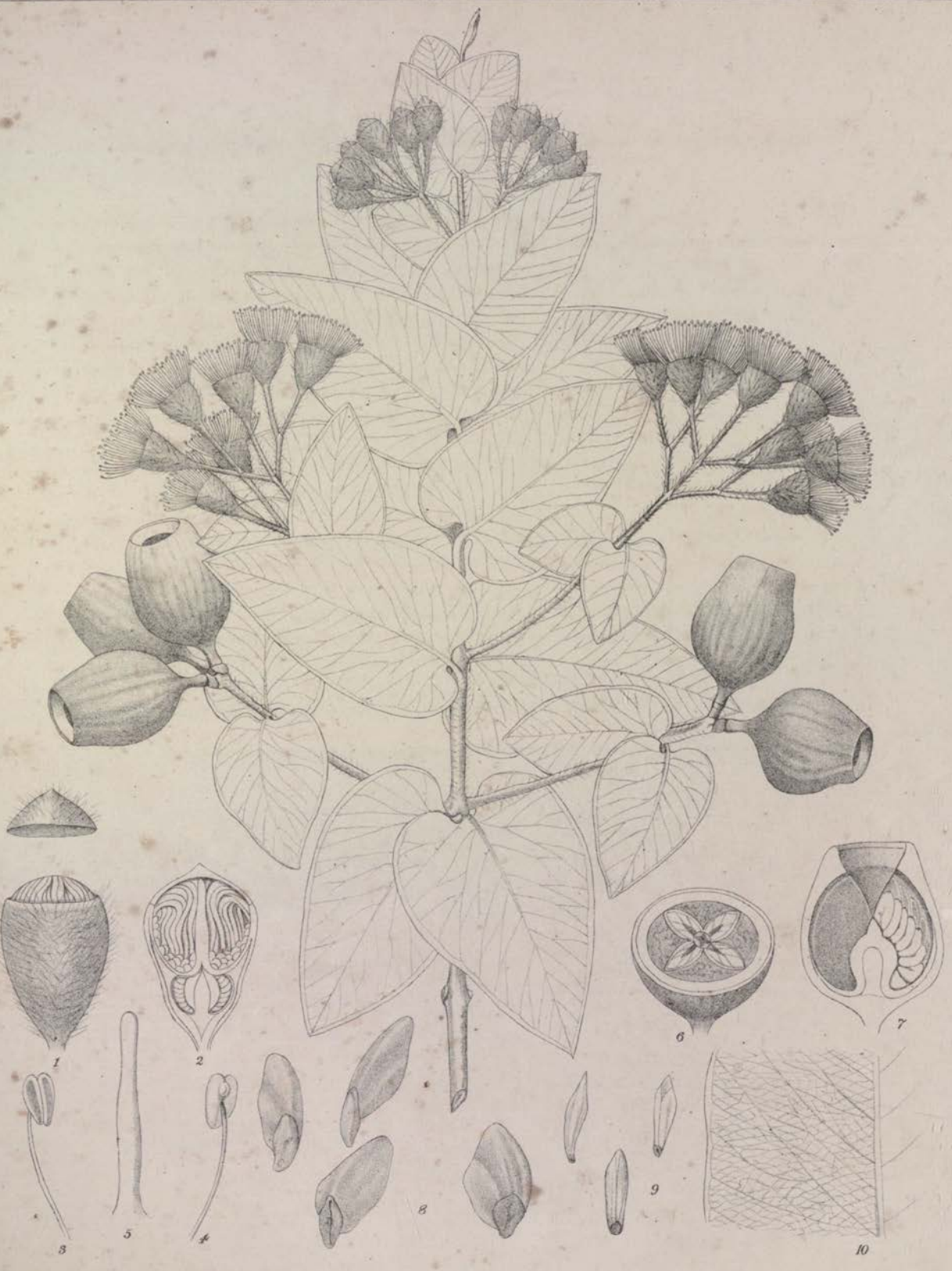
The coast-variety of E. punctata produces thicker and larger leaves and also larger flowers and fruits.

The rate of growth, on which so very much depends for judging of the comparative value of Eucalypts for timber-plantations, shows itself from trees, raised by me many years ago on dry ridges near Melbourne, sufficiently fast advancing, to permit of this species being included among those recommendable for practical forestry. We are mainly indebted to Dr. Woolls, who instituted since the last quarter of a century observations on the Eucalypts of the Blue Mountains and the vicinity of Sydney, for the restoration of E. punctata to specific rank.

The wood of E. punctata, as well as that of E. rostrata, E. marginata and E. Sieberiana (among species examined microscopically on this occasion) exhibits the parenchyma and medullary rays tinged with a decidedly red-brown color, indicative of preservative deposits in the cells. This tinge, when viewed under the microscope, is much paler in E. obliqua, E. globulus, E. amygdalina, E. Stuartiana, E. goniocalyx, E. Gunnii, E. viminalis, E. hemiphloia, E. Behriana, E. melliodora, E. botryoides and E. macrorrhyncha; in E. polyanthema the medullary rays of microscopic objects are deeply colored, but the parenchyma shows hardly any tinge. The wood-sections had previously all been subjected to the action of water, alcohol and glycerine. In accordance with the above observations E. punctata will probably rank high in its resistance to decay underground and in any waterworks.

Perhaps here it may be aptly remarked, that the question has repeatedly arisen, how the injury, caused to heavy logs of timber through the tremendous shock sustained by falling on hard bare and particularly rocky ground, could to some extent be obviated, the timber in its fall being severely shaken,—although (as Mr. George Simpson observes in regard to the Jarrah) this may not be discernible until some time after it is sawn. I would advise, that in a regular system of Australian Forestery the Tanners' Wattles (particularly Acacia decurrens) should be sown on any bare places around huge Eucalyptus-trees some years prior to the intended utilisation and removal of the latter, as a dense underwood of wattles would materially break the force of the fall of any heavy timber-trees.

EXPLANATION OF ANALYTIC DETAILS.—1, unexpanded flower, the lid lifted; 2, longitudinal section of an unexpanded flower; 3, stamens in situ; 4 and 5, front- and back-view of a stamen; 6, style and stigma; 7 and 8, longitudinal and transverse section of a fruit; 9 and 10, fertile and sterile seeds; 11, portion of a leaf; all magnified, but to various extent.



Tooth. del. C. Troedel & Co. Lith.

F. v. M. direxit

Steam Litho Gov. Printing Office Melb.

Eucalyptus setosa. *Schauer.*

EUCALYPTUS SETOSA. 58

Schauer, in Walpers repertorium botanices systematicæ ii. 926 (1843); F. v. M., fragmenta phytographiæ Australiæ iii. 132; Bentham, flora Australiensis iii. 254.

Arborescent; *leaves opposite, ovate- or roundish-cordate, sessile,* somewhat rough, of pale and dull color on both sides and of rather thin consistence; their primary lateral veins somewhat distant, very spreading and but slightly prominent, the circumferential vein irregular and not much removed from the edge; oil-dots obliterated; *panicles terminal, as well as the branchlets beset with bristly brownish hairs and also glandular-rough;* umbels with very few or several flowers; stalklets slender, mostly longer than the almost pearshaped calyx; *lid depressed-hemispherical, slightly or conically pointed, seceding by an irregular transverse line,* much shorter and less wide than the tube; stamens all fertile, inflexed before expansion; anthers oblong-oval, opening by longitudinal parallel slits; style short; stigma not dilated; *fruits large, globular-ovate and truncated, somewhat urnshaped,* not angular, 3- to 4-celled; rim descending; valves deeply enclosed, deltoid; *fertile seeds provided with a large terminal membranous appendage,* sterile seeds much smaller and narrow.

On the islands of the Gulf of Carpentaria (R. Brown, Henne), also on the mainland around the Gulf (F. v. M.), extending south-eastward at least as far as Mount Elliot (Fitzalan).

A low spreading tree, generally occurring on fertile soil. Bark, according to a note of Mr. Fitzalan, stringy, thus persistent as in other Bloodwood-trees, to which series this species belongs. Some few of the leaves occasionally scattered. Transparent ducts only visible in the young leaves and then only as very minute irregular pores and not as roundish oil-dots; hence the foliage (at least when dry) inodorous. Stalklets of the umbels chiefly opposite. Lid rather tearing off irregularly and tardily, than dropping suddenly and completely by a clear sutural dehiscence, remaining often for a while attached during the expansion of the flowers to one side of the orifice of the calyx-tube, as in other Bloodwood-trees. Fruits on quite slender stalklets, pale and not shining outside, very blunt at the base; placentas prominent, near the summit of the septa. Fertile seeds rather large, black-brown and shining, their appendage pale- or dark-brown. Characteristics of the seedlings as yet unobserved. R. Brown noted a smooth ash-grey bark; unless his note applies to E. aspera, which is known to possess such a bark, it would appear, that the cortical characters of E. setosa are variable, though in a hurried collecting excursion the two trees may possibly not have been recognized in their distinctness by the illustrious naturalist of Flinders's expedition.

E. aspera approaches this species in the roughness of the branchlets and much in foliage, though its leaves are generally not so large and comparatively not so broad; but the smooth calyces with polished lid, the small fruits with sharp edge and the seeds not provided with appendages bring that species into much closer contact with E. clavigera and also with E. ferruginea, except in the size of the fruit.

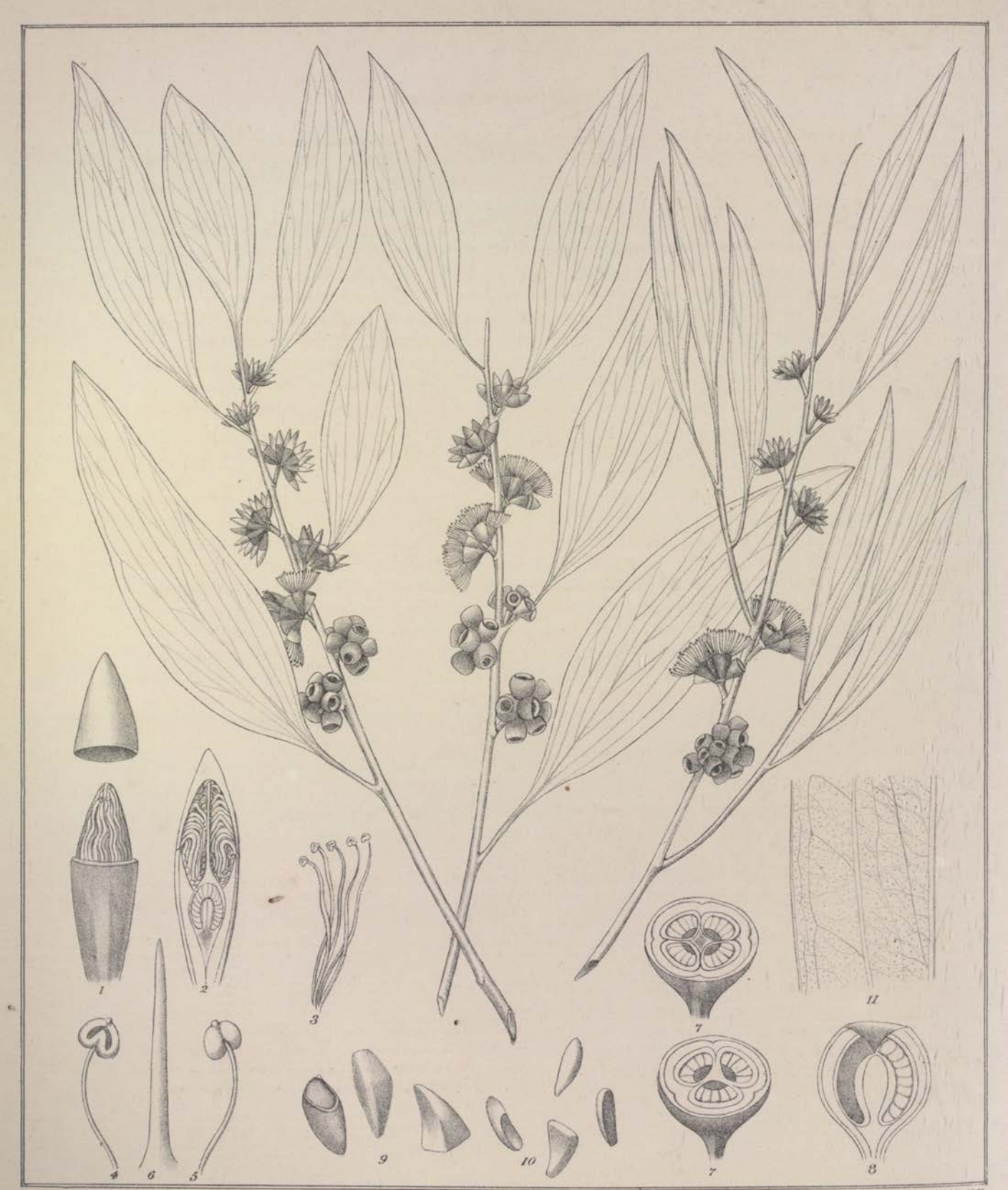
The resemblance of E. setosa to species of the genus Angophora is most striking, especially on account of the reddish- or dark-brown stiff short hairs, which are most copiously developed on the branchlets and inflorescence; this renders their similarity in habit complete. Indeed, as pointed out in the article on the E. tetragona, the only difference between the genera Eucalyptus and Angophora consists in the calycine lid of the former being replaced by the true petals of the latter.

Amongst its own congeners E. setosa must find a systematic place near E. corymbosa, E. terminalis, E. dichromophloia, E. trachyphloia and their allies, which all exhibit a similar imperfectly defined dehiscence of the calyx.

Of the technic value of the tree now under consideration nothing is known; it is probably not of sufficient dimensions to serve for timber, but yields in all probability Kino like several allied species. In organographic respect it is of great interest. In a recently received note Mr. Fitzalan describes the bark as brown or blackish, hard and ridged as in the case of the Ironbark-trees, and he notes, that he found the tree to reach the summits of mountains. The number of stomata seems variable, as in one case they amounted to 149,000 on the lower page of the leaves, but only to 108,000 on their upper side; such leaves were likely from very young trees or grown under shade.

In our efforts to introduce or diffuse any Eucalypts into culture on a large scale, we enjoy singular facility, inasmuch as the seeds are so easily gathered and as their transmission on account of their smallness can be so readily effected; moreover they will maintain their germination-power for some time (several years at least in some cases), provided they are stored in dry and cool places. Indeed it seems marvellous to contemplate, that trees, known to be among the largest of the world, arise from seed-grains so minute. Thus Eucalypts are transferred to distant lands far more easily than Oaks, Walnut-trees, Hickories, Teak, Sal Sissoo and perhaps any other important kind of hardwood-trees, though their constitution limits them mostly to frostless zones and within the tropics to dry or higher mountainous regions, and though their wood cannot always replace that of many other kinds of select timber-trees. A very extensive trade in Eucalyptus-seeds arose already many years ago, to the initiation of which the author of this work can lay largely claim.

Explanation of Analytic Details.—1, unexpanded flower, the lid lifted; 2, longitudinal section of an unexpanded flower; 3 and 4, front- and back-view of anthers; 5, style and stigma; 6 and 7, transverse and longitudinal section of a fruit; 8 and 9, fertile and sterile seeds; 10, portion of a leaf; all magnified, but to various extent.



Todt del. C.Troedel & Cº Lith. F.v.M. direxit Steam Litho Gov. Printing Office Melb.

Eucalyptus stellulata. *Sieber.*

Sieber, in De Candolle prodromus systematis naturalis regni vegetabilis iii. 217 (1828); De Candolle, mémoire sur la famille des myrtacées, planche 6 (1842); F. v. M., fragmenta phytographiæ Australiæ ii. 45; Bentham, flora Australiensis iii. 200.

Leaves scattered, on rather short stalks, from oval- to narrow-lanceolar or rarely linear-lanceolar, of firm consistence, hardly inequilateral, not much elongated, shining and of equal color on both sides; primary *veins almost longitudinal*, mostly prominent, three of them arising almost jointly from near the acute base of the leaf, the circumferential vein removed from the edge; oil-dots much concealed or quite obliterated; general flowerstalks short, cylindrical, expanded at the summit, solitary, axillary or lateral; *flowers minute, rather numerous, crowded into head-like umbels*; *lid semiovate-conical, acute*, smooth, very shining, about as long as the tube of the calyx; stamens all fertile, inflexed before expansion; *anthers cordate-kidneyshaped*, opening by much diverging slits; stigma not dilated; *fruits very small*, semiovate or truncate-globular, not angular, mostly 3-celled, rim comparatively broad, valves short, enclosed; seeds without any appendage, the sterile seeds usually not narrow.

Along elevated river-valleys or flats and in cooler mountain-regions up to the subalpine zone; thus on the upper Hume-River (Findlay), on the Mitta-Mitta, around the Barkly-Range, towards Lake Omeo and on the Upper Genoa (F. v. M.), in the counties of Camden and Argyle (Mrs. Calvert), ascending to the summits of the Blue Mountains (Rev. Dr. Woolls), extending to Mudgee and Braidwood (Wilkinson), Bathurst (Cunningham), Mittagong (Rev. James Hassell), New England (Leichhardt), descending in Gippsland to Dargo-flat (Howitt), mostly in basaltic areas, but also in the granite-formation, not rarely following the courses of mountain-streams.

A tree, attaining a height of 50 feet, but seldom a stem-diameter of over 10 inches, remaining in cold elevations at about 4,000 feet of shrubby growth, known as the "Black Sallee" or "Muzzlewood" (Howitt), but more frequently as the "Green-barked Gum-tree." Bark of the trunk rough, dark and somewhat scaly and fibrous, persistent at least on the lower part of the stem, but smooth on the branches and sometimes also (from decortication) on the upper part of the stem and there greenish or green-brownish or of a bronze-hue. In its shrubby stemless state already flowering and fruiting copiously. Leaves often only 2 to 3 inches long, attaining however sometimes a length of 5 inches. Flowers in the umbels from 15 to 6, rarely fewer still. Stamens 2–3 lines long; filaments finely capillary. Style comparatively elongated. The specific name alludes to the clustered flowers, arranged somewhat star-like, in the manner of the fruits of Carex stellulata (of Goodenough, C. echinata of Murray), with which sedge Sieber was well acquainted. The Revd. James Hassell, the Revd. Rob. Collie and the Revd. Dr. Woolls found the stems often so smooth that the latter places E. stellulata even among the Leiophloiæ (Lectures on the Vegetable Kingdom, p. 117), whereas I found cause from observations over rather extensive areas to assign to this tree a place among the Rhytiphloiæ. The foliage is rather dense and shady. The timber is not of much avail, either in quality or dimensions, but it affords a good fuel, burning well. Practically the tree is of most importance on account of its hardiness, and it would be sure to live in Britain on the Channel-islands, where extensive tests on the endurance of cold might well be instituted with many other Eucalypts. E. stellulata exudes Kino in considerable quantity. As a species it is well marked, because in the longitudinal course of the lateral nerves of the leaves it has only an imitator in E. pauciflora, but the last mentioned congener attains greater dimensions, has always wholly smooth bark, larger leaves, umbels usually on longer stalks and always with larger flowers, the lid considerably shorter than the tube of the calyx and less acute or quite blunt, and the fruit also conspicuously larger.

The shrubby highland-state of E. stellulata is in general aspect so similar to E. stricta, that Allan Cunningham did not draw any distinctions between the two, and published them as one under the name of E. microphylla (in Field's Geographical Memoirs on New South Wales 350, anno 1825). G. Don, who changed the name to E. Cunninghami (General System of Dichlamydeous Plants ii. 821) simply followed in this view of their identity. Both kinds grow intermixed on the summits of the Blue Mountains, in both the venation is often reduced to extreme fineness. The differences of E. stricta consist in the aged bark not being stringy, diverging veins of the leaves, fewer flowers in the umbels on longer stalklets and of larger size, granular-rough calyces larger usually 4-celled fruits with a prominent edge around the orifice.

It may here however be observed cursorily, that I comprehend as E. stricta a plant of the series Renantheræ, precisely agreeing, so far as fruit-specimens are concerned, with original specimens of Sieber's collection (No. 472), obtained from Dr. Sonder of Hamburg, although Bentham, perhaps solely from examination of undeveloped flowerbuds, places E. stricta among the Micrantheræ. It is confined to New South Wales and delights in the higher, cool and moist regions of mountains, braving some frost, and as may be imagined from its frequent exposure to boisterous weather, it is startlingly playful in its variability. Thus it includes E. cneorifolia of De Candolle's mémoire sur la famille des myrtacées, pl. 9, but only the eastern plant so named in De Candolle's prodromus iii. 220, and not the one from the arid dry ridges of l'île Decrès or Kangaroo-Island, which seems referable to E. oleosa among Parallelantheræ. To E. stricta belongs furthermore E. rigida of Sieber's collections, No. 473, although united by Bentham with E. obtusiflora, but the latter according to leaves from the original specimen kept at Geneva and forwarded to me by Monsieur Alphonse De Candolle proves it completely distinct from E. rigida. E. stricta is so variable, that Sieber distributed a variety of it under a third name, viz., E. virgata, as is now found from inspection of an authentic specimen (though in bud only) sent recently to me by Dr. Henri van Heurck of Antwerp. Bentham united this with the tall species, to which I have given the appellation of E. Sieberiana, whereas the genuine E. virgata was most likely gathered with the other varieties of E. stricta on the summit of the Blue Mountains, where with a dwarf state of E. stellulata it forms thickets of rigid strict-branched virgate bushes. At a first glance any collector would deem E. virgata very distinct, more particularly on account of the much compressed and two-edged stalks of the umbels, as already noticed in Sprengel's curæ posteriores 195; but a still more remarkable form, widely aberrant from the original type, was discovered by Mr. Kirton on the crests of high barren ranges towards Bulli, which variety seemed so very distinct, that it was actually described as a new species under the name of E. Luehmanniana (fragmenta phytographiæ Australiæ xi. 38) with not the slightest anticipation at the time, that any additional material would establish a transit to E. stricta, as has been the case since; the leaves of the variety Luehmanniana are long and comparatively broad, the umbel-stalks are wedgeshaped-dilated and as well as the branchlets and calyces tinged with a bluish-white bloom, the flowers and fruits are much larger, the lids are gradually long-pointed and the number of valves is often increased to 5 or 6.

Explanation of Analytic Details.—1, unexpanded flower, the lid lifted; 2, longitudinal section of an unexpanded flower; 3, some stamens in situ; 4 and 5, front- and back-view of an anther with part of its filament; 6, style and stigma; 7 and 8, transverse and longitudinal sections of a fruit; 9 and 10, fertile and sterile seeds; 11, portion of a leaf; all magnified, but to various extent.

Todt del. C. Troedel & Co Lith. F.v.M. direxit. Steam Litho Gov. Printing Office Melb.

Eucalyptus tetragona. *F.v.M.*

EUCALYPTUS TETRAGONA. 60

F. v. M., fragmenta phytographiæ Australiæ iv. 51 (1864); Bentham, flora Australiensis, iii. 259; E. pleurocarpa, Schauer, in Lehmann plantæ Preissianæ i. 132; Eudesmia tetragona, R. Brown, in Flinders's voyage to terra Australis ii. 599, t. 3; Sweet, flora Australasica t. 21.

Shrubby or somewhat arborescent; branchlets stout, prominently quadrangular, tinged by a chalky-white bloom; *leaves opposite*, rarely some scattered, of thick consistence, from ovate-lanceolar to ovate or rarely orbicular, nearly equilateral, on flat and rather long stalks, of equal color on both sides; their lateral veins numerous, pennately spreading, rather prominent, the circumferential vein removed from the edge; the oil-dots much concealed; flowerstalks axillary, solitary, compressed, sharply biangular, with 3 or seldom 4 or 5 or 1 or 2 flowers; stalklets compressed, as long as the calyx or often shorter; tube of the calyx truncate-ovate, faintly 4-toothed, considerably longer than the depressed hemispheric lid; *stamens forming four distinct bundles*, inflexed before expansion; anthers minute, oval-globular, opening with longitudinal slits; style short; stigma not dilated; fruits rather large, truncate-ovate or sometimes verging towards a globular form, angular from 2 or oftener 4 longitudinal lines, 4- or rarely 5-celled; rim descending, not flat; valves enclosed near the orifice, very short; *fertile seeds surrounded by a narrow tender membrane*, very angular, much larger than the sterile seeds.

From Cape Arid (Maxwell) to Lucky Bay (R. Brown), Cape Riche (Preiss), South-West Bay (Oldfield), the vicinity of Stirling's Range (F. v. M.) and thence northward at least as far as the remotest sources of Swan-River (Th. Muir).

A tall shrub, rising finally to a tree of 25 feet, though fruiting already when only a few feet high, apt to be kept dwarfed by being consumed down to the root by the periodical bushfires, which are originated by the nomadic inhabitants of the native grounds of this species, the whole plant being very combustible from the pervading oil of the foliage. This bush reminds of the young state of E. globulus, with its opposite leaves and the sharply quadrangular branchlets, white (as well as the inflorescence) from its waxy-powdery exudation.

The differences between E. tetragona and E. eudesmioides, whether indicative of the value of species or only varieties, consist in the much narrower leaves of E. eudesmioides, the absence of the waxy-powdery whiteness, less or not compressed flowerstalks, smaller flowers and fruits, prevailing ternary number of fruit-valves. E. eudesmioides has been traced by the writer in 1877 from the Arrowsmith-River to near Shark-Bay over sand- and limestone-ground. A large-fruited form of this plant from Esperance-Bay, referred to E. tetragona in the flora Australiensis, seems to mediate the transit from one to the other; it is without whitish bloom and may exhibit the aged state of the species. E. tetragona is through E. eudesmioides also cognate to E. odontocarpa, of which well-developed flowers remained as yet unknown; the differences of the latter consist in still narrower and somewhat curved leaves with more spreading veins, in the smallness of its flowers with proportionately more developed calyx-teeth, and the not membranously margined seeds; very possibly its anthers will bring it nearer to E. tetrodonta.

Its mainly shrubby growth gives E. tetragona probably no claim to the practical attention of any artisans; but a plate has been devoted here to its elucidation, as this species is of particular structural interest in regard to its flowers. It shares with E. erythrocorys the remarkable characteristic of having its stamens united into bundles, which alternate with the teeth of the calyx, though the filaments do not actually unite, but are inserted on semiorbicular lobes, different in color and consistence. On this distinction rests R. Brown's genus Eudesmia (Appendix to

Flinders's voyage ii. 599, t. 3), which to some extent holds the same position towards Eucalyptus as Melaleuca towards Callistemon and as Tristania towards Metrosideros ; the coalescence of the filaments of Melaleuca is one of degree only and even in the typical Melaleuca Leucadendron affects merely the very base of the staminal bundles. But as in all three hitherto known Eudesmias hardly any concrescence of the filaments themselves is traceable, I deemed it best to include them in the genus Eucalyptus, especially as calyx-teeth are still more strongly developed in E. odontocarpa and E. tetrodonta. The denticulated calyx of these Eucalypts offers an approach to the genus Angophora, which indeed can only be kept strictly separated by the development of distinct petals, the operculum of Eucalyptus being truly calycine, unless a tender membraneous free inner lid of rare occurrence should be regarded as a transit to some petaloid structure. The genus Eucalyptus—well marked as it is—shows further some affinity to a genus of the Pacific Islands, namely Acicalyptus (A. Gray in Wilkes' United States Exploring Expedition 551, t. 67), in which however the petals are developed, though sometimes irregularly so, and in which the fruit becomes succulent in its outer portion, maturing only one or two large seeds with thick cotyledons, so far as this could hitherto be demonstrated from a congener restricted to Lord Howe's Island (F. v. M., fragmenta phytographiæ Australiæ viii. 16) ; the two-celled ovary, characteristic for Acicalyptus, is also typical for Eucalyptus phœnicea and occurs though very exceptionally in at least one other species (E. trachyphloia). The so-called Eucalyptus-forests of New Ireland, mentioned by the Reverend George Brown, are possibly formed by a species of Acicalyptus. The affinity of Calyptranthes, a genus widely spread over tropical and subtropical America, is more remote, though its petals are generally only rudimentary, or as in Eucalyptus also quite absent.

Explanation of Analytic Details.—1, unexpanded flower, its lid lifted; 2, longitudinal section of an unexpanded flower; 3, longitudinal section of an expanded flower; 4, some stamens in situ; 5 and 6, front- and back-view of an anther, with a portion of its filament; 7, style and stigma; 8 and 9, longitudinal and transverse section of fruit; 10 and 11, fertile and sterile seeds ; all magnified, but to various extent.

EUCALYPTOGRAPHIA.

A DESCRIPTIVE ATLAS

OF THE

EUCALYPTS OF AUSTRALIA

AND THE

ADJOINING ISLANDS;

BY

BARON FERD. VON MUELLER, K.C.M.G., M. & PH.D., F.R.S.,

GOVERNMENT BOTANIST FOR THE COLONY OF VICTORIA.

"NON SUCCIDES ARBORIS, NEC SECURIBUS DEBES VASTARE EARUM REGIONEM."—*Liber Deuteronomii* xx. 19.

SEVENTH DECADE.

MELBOURNE:

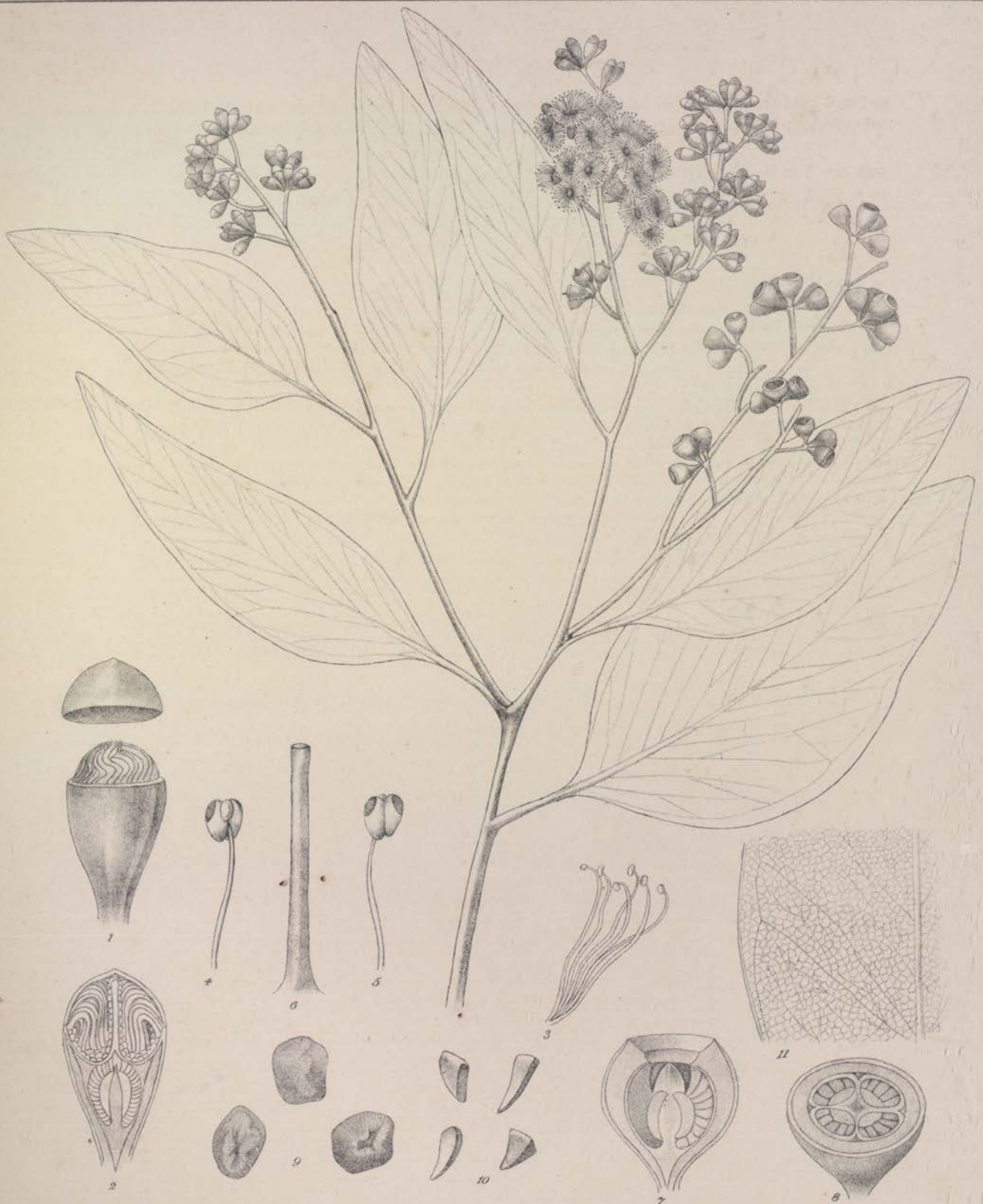
JOHN FERRES, GOVERNMENT PRINTER.

PUBLISHED ALSO BY GEORGE ROBERTSON, LITTLE COLLINS STREET.

LONDON:

TRÜBNER AND CO., 57 AND 59 LUDGATE HILL; AND GEORGE ROBERTSON, 17 WARWICK SQUARE.

M DCCC LXXX.



Todt. del. C. Troedel & Cº Lith. F. v. M. direxit. Steam Litho Gov. Printing Office, Melb.

Eucalyptus Behriana. *F.v.M.*

F. v. M., in the transactions of the Victorian Institute 1854, p. 34; Miquel, in Nederlandisk Kruidkundig Archief iv. 139 (1859); Bentham, flora Australiensis iii. 214.

Shrubby, becoming arboreous; *leaves broadish- or oval-lanceolar, almost equilateral,* of thick consistence, of equal color and shining on both sides, not or only slightly curved; their lateral veins somewhat prominent, rather distant, not very spreading, the circumferential vein conspicuously removed from the edge of the leaf; oil-dots much concealed or obliterated; *umbels in mostly terminal not very spreading panicles, with seven or fewer small flowers in each;* stalklets very short; the tube of the calyx truncate- or semi-ovate, about twice as long as the almost hemispheric lid, not angular; stamens all fertile, inflexed before expansion; *anthers very minute, nearly globular, opening laterally by pore-like apertures;* stigma not broader than the short style; fruits small, truncate- or topshaped-ovate, 3- or oftener 4-celled; their rim narrow; valves enclosed, very short; seeds without any appendage, the fertile considerably larger than the sterile seeds.

Near the sources of the Werribee-River, on stony hills, extending thence to the Avoca (F. v. M.); in the scrubs of Sandarac-Cypresses near the Gawler-River (Dr. Behr); in the hilly forest-region of Wirrabara near Crystal-Brook and Mount Remarkable on deep marly clay-soil (J. E. Brown) and probably in many interjacent places.

A tall shrub or small and perhaps never a tall tree. Outer bark in large brownish or dark flakes deciduous, leaving the surface of the stem and main-branches smooth and greenish. Foliage rather massive; leaves scattered, occasionally tinged with whitish bloom. Calyces shining; their tube gradually tapering into the stalklet. Valves not rarely inserted very near the summit of the orifice of the fruit, but sometimes more deeply seated.

Mr. J. E. Brown, the Forest-Inspector of South-Australia, found E. Behriana always on soil, richer than that occupied by E. odorata and E. hemiphloia. He notes the height 16 to 20 feet, but the foliage spreading out diametrically to 20 to 25 feet.

The variety *purpurascens,* recorded in the flora Australiensis from the western side of Spencer's Gulf, may be referable to E. hemiphloia and requires further examination in the native spots of its growth.

In its relationship E. Behriana approaches closely to E. hemiphloia, from which it mainly differs in never attaining the stately dimensions of that species, in the bark remaining smooth from secession of the outer layers; besides the leaves are as a rule (subject however to exceptions) shorter and broader, the panicles are less ample, by which means the umbels are not rarely arranged in a racemous manner; the flowers and fruits are smaller, their stalklets are more abbreviated, the lid is shorter and blunter and the fruit-valves are less deeply enclosed. E. Behriana claims also near affinity with E. largiflorens, but the bark of the latter persists, the leaves are conspicuously narrower, of thinner consistence, of duller hue, finer veined and better provided with oil-dots, its panicles are more spreading, the lids are (at least often) double and the stamens not constantly all fertile; thus the resemblance of E. Behriana in foliage is closer to E. hemiphloia, but in flowers and fruits nearer to E. largiflorens, while in bark it differs from both. No other species could easily be mistaken for E. Behriana, as E. odorata, which comes also near to it in affinity, is discriminable by the mainly axillary inflorescence and persistent bark. The technical quality of the wood of E. Behriana remained hitherto untested.

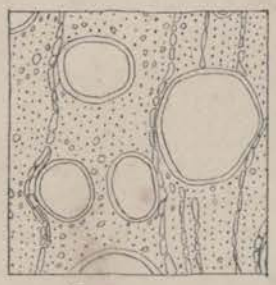
The stomata of the leaves are not always isogenous, as recorded before, but have been found to be also 91,000 on a square inch of the upper page and 104,000 on the lower page; this diversity arises probably from the age of the plant.

This species was named by me already in 1849 after Dr. Herman Behr, by whom it was then discovered in South Australia, and where already by his prior travels he had shed much light on the Flora and Fauna; this ardour for scientific research was displayed by him unabated for the last thirty years in California, where he more particularly has contributed to the entomologic elucidation of that country.

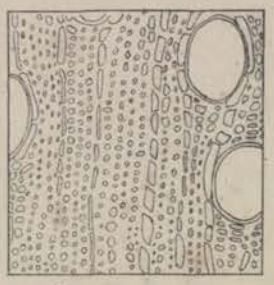
EXPLANATION OF ANALYTIC DETAILS.—1, an unexpanded flower, its lid lifted; 2, longitudinal section of an unexpanded flower; 3, some stamens in situ; 4 and 5, back- and front-view of an anther with portion of its filament; 6, style and stigma; 7 and 8, longitudinal and transverse section of a fruit; 9 and 10, fertile and sterile seeds; 11, portion of a leaf; all magnified, but to various extent.

EXPLANATION OF ANATOMIC PLATE.—Transverse sections of the wood of Eucalyptus amygdalina, E. Behriana, E. botryoides, E. globulus, E. goniocalyx, E. Gunnii, E. hemiphloia, E. macrorrhyncha, E. melliodora, E. obliqua, E. polyanthema, E. punctata, E. rostrata, E. Sieberiana, E. Stuartiana, and E. viminalis. The large openings represent the vascular tubes; the rows of elongated cells constitute the medullary rays; the scattered cells and those near the vascular openings exhibit parenchyma; the multitudes of smallest apertures indicate the closely set wood-fibres. Augmentation 80 times. (These microscopic sections are given to aid in the discrimination of mercantile Eucalyptus-timber of doubtful origin, such as sometimes occurs in the trade.)

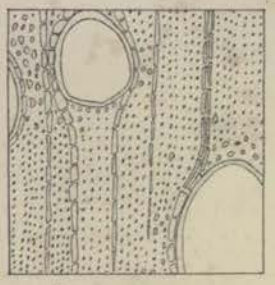
E. AMYGDALINA.



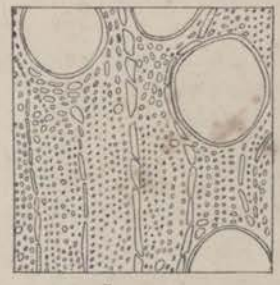
E. BEHRIANA.



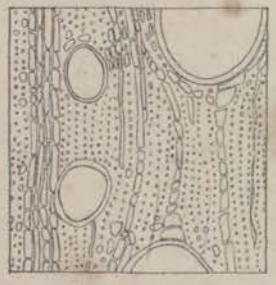
E. BOTRYOIDES.



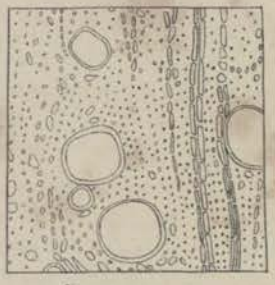
E. GLOBULUS.



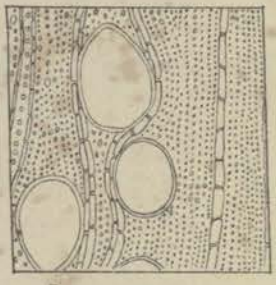
E. GUNNU.



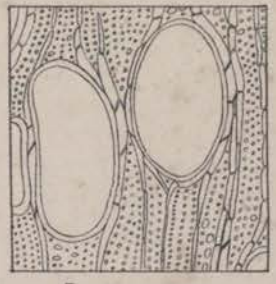
E. GONIOCALYX.



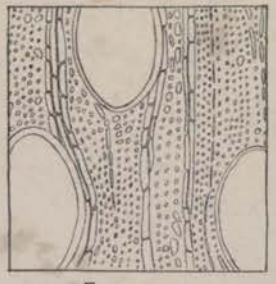
E. HEMIPHLOIA.



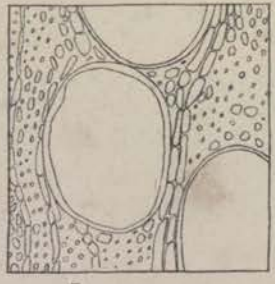
E MACRORRHYNCHA.



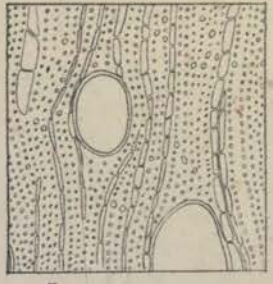
E. MELLIODORA.



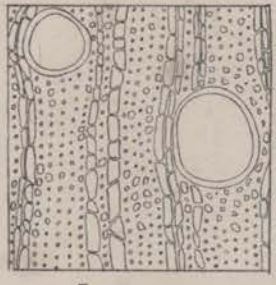
E. OBLIQUA.



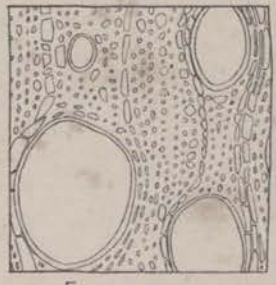
E. PUNCTATA.



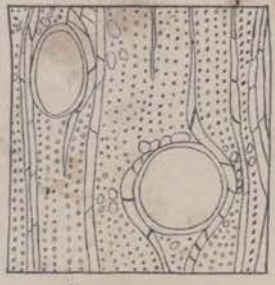
E. POLYANTHEMA



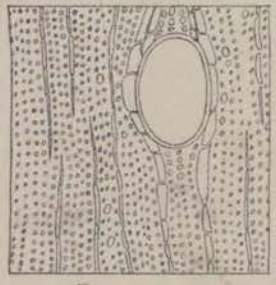
E. ROSTRATA.



E. STUARTIANA.



E. SIEBERIANA



E. VIMINALIS.

L. Rummel del. C. Troedel & Co. Lith. F. v. M. direxit. Steam Litho Gov. Printing Office Melb.

Eucalyptus - Wood, *transverse sections,* $\frac{1}{80}$.

Todtidel. C. Troedel & Cº Lith.

F.v.M. direxit.

Steam Litho Gov. Printing Office Melb.

Eucalyptus cosmophylla. *F.v.M.*

EUCALYPTUS COSMOPHYLLA. 62

F. v. M., in the transactions of the Victorian Institute 1854, p. 32; Miquel, in Nederlandisk Kruidkundig Archief iv. 134 (1859); Bentham, flora Australiensis iii. 225.

Always *shrubby; leaves of thick consistence*, scattered, ovate-lanceolar or sometimes broadly ovate, nearly straight or slightly curved, rarely almost sickleshaped, equally greyish- or pale-green on both sides, not shining; the lateral veins thin, moderately spreading, not closely approximated, the circumferential vein at some distance from the edge of the leaf; oil-dots much concealed or almost obliterated; *flowers rather large, axillary, one to five together on a very short stalk* and provided with hardly any or very abbreviated stalklets; lid almost hemispherical, slightly or sometimes conspicuously pointed, not quite so long as the semiovate faintly angular tube of the calyx; stamens all fertile, inflexed before expansion; anthers almost ovate, opening with longitudinal slits; stigma not broader than the style; fruit semiovate or almost hemispherical, 4- to 6-celled; *rim broad;* valves short, convergent, affixed not far below the orifice, enclosed or slightly exserted; seeds without appendage, the fertile broader than most of the sterile seeds, but not longer and very angular.

On Mount Lofty and on the surrounding mountains, also on the Bugle-Ranges, occupying dry stony places and forming occasionally the underwood in the forests of E. obliqua (F. v. M.); on hills near Encounter-Bay (Whittaker); on bushy ridges of Kangaroo-Island (Waterhouse).

A rather tall shrub, seldom somewhat arborescent, flowering already at the height of 5 feet. Bark smooth, greyish. Branchlets robust, towards the summit angular. Leaves conspicuously stalked, attaining a length of 5 inches, and a breadth of 2 inches; some of their veins rather prominent. Flowerstalks up to ½ inch long, often variously shorter, angular, but not flattened; occasionally two flowerstalks from the same axil. Stalklets hardly ever attaining ¼ of an inch in length and not rarely quite deficient. Calyces slightly shining and not quite smooth; the angular lines of its tube (if present) 2 to 3, more prominent towards the base; lid not angular, not rarely terminating in a short acute pyramidal-conical apex. Anthers dorsifixed, attenuated downward. Style angular. Fruit usually ½ to ⅔ of an inch but occasionally only ⅓ inch wide; rim at last convex from the protrusion of the discal lining beyond the margin of the calyx-tube. Disc between the stamens and style during the time of flowering intensely yellow, almost orange, becoming black-brown afterwards. Fertile seeds black, slightly rough, hardly or not fully one line long.

I recorded the seedlings (fragmenta phytographiæ Australiæ vii. 43) as smooth, with not angular stem and small mostly opposite oblong leaves on short stalks.

This Eucalyptus derived its specific name from its handsome foliage, the boughs with leathery-rigid not quickly fading leaves serving for rustic decorative purposes, as noticed by me already in 1848.

Bentham placed it near E. alpina, from which the more pointed generally elongated and not shining leaves, the presence of flowerstalks, the larger flowers, smooth calyces with thinner lids, the oval anthers and the less hemispheric fruits readily distinguish it. E. cosmophylla might be likened also to the still more ornamental E. Preissiana, but that species has often partially opposite or nearly opposite mostly quite blunt and still thicker leaves of more vivid and somewhat shining verdure, its flowerstalks are generally longer and always broadly compressed and at first turned downward, the flowers and fruits are in most instances larger, sometimes much so, the

filaments are bright-yellow, the rim of the fruit is more descending, the valves generally somewhat deeper enclosed and outward tumid, and the seeds larger as well as more uniformly broad. E. cosmophylla verges in its affinity also somewhat to E. megacarpa, although that species forms a good-sized tree, has narrower thinner and darker leaves, broader and flat flowerstalks, larger at the base rather less turgid fruits with finally convex emersed summit and very thick valves, larger and also broader sterile seeds.

This Eucalyptus has but slight claims on the industrial attention of artisans, but for completion's sake it could not well be passed in this work, especially as the flowers, which expand in autumn, offer by their sweet exudations also food for bees at a season, when it is particularly welcome to them.

The ordinarily dry leaves gave 13½ per cent. of tannin (according to a solitary experiment instituted by Mr. Rummel in my laboratory), equal to nearly 15 per cent. in absolutely dried leaves ; they are therefore richer in tan-principle than even those of E. Leucoxylon, although not to the same vast extent obtainable for tanneries. The medullary rays in the wood of E. cosmophylla are more copious than in most other Eucalyptus-woods (380 per square inch, against 220 in real boxwood, which furnishes the best standard for comparisons of wood-elements) ; the vascular tubes are also more numerous than in many other species (11,000 per square inch, against 165,000 in Buxus sempervirens).

Explanation of Analytic Details.—1, unexpanded flower, the lid lifted ; 2, longitudinal section of an unexpanded flower ; 3, some stamens in situ ; 4 and 5, front- and back-view of an anther, with portion of the filament ; 6, style and stigma ; 7, longitudinal section of a fruit ; 8, transverse section of three different fruits ; 9 and 10, sterile and fertile seeds ; 11, embryo in its natural position ; 12, transverse section of an embryo ; 13, embryo with cotyledons unfolded ; all magnified, but to various extent.

Todt.del. C.Troedel & Cº Lith.

F.v.M. direxit.

Steam Litho Gov. Printing Office, Melb.

Eucalyptus ficifolia. *FvM.*

F. v. M., fragmenta phytographiæ Australiæ ii. 85 (1860); vi. 25 (1867); Bentham, flora Australiensis iii. 256 (1866); F. v. M., Report on the Forest-resources of Western Australia p. 5, pl. 3 (1879).

Tall; *leaves* scattered or some almost opposite, broad- or ovate-lanceolar, or some nearly ovate but always acute, rigid, almost equilateral, dark-green above, *much paler and not shining beneath; veins subtle, almost transversely spreading, closely parallel,* the circumferential vein nearly contiguous to the slightly recurved edge of the leaf; oil-dots concealed or obliterated; umbels usually 4- to 6-flowered, terminal, mostly paniculated; their stalks conspicuous, nearly cylindrical; *calyces large, pearshaped,* on slender stalklets of about equal length, not angular; *lid thin, very depressed, many times shorter than the tube of the calyx and only about half as broad; filaments crimson,* all fertile, inflexed and dependent while in bud; anthers ovate-ellipsoid, opening with longitudinal slits; stigma not dilated; *fruits large, urnshaped-ovate,* 3- to 4-celled; rim narrow; valves deeply enclosed, deltoid; *fertile seeds pale-brown, terminated by a long membranous appendage,* much larger than the mostly narrow sterile seeds.

From the western side of Irwin's Inlet to the entrance of the Shannon, constituting a distinct forest-belt in the coast-region, though not actually approaching the sea-shore.

An umbrageous tree, seldom exceeding a height of 50 feet. Bark persistent, furrowed. Branchlets rather stout. Leaves provided with conspicuous stalks, somewhat of leathery thickness, turning more the surface than the edge to the zenith, seldom narrow-lanceolar, occasionally more shortened, always somewhat decurrent into the stalk, pointed at the apex and sometimes narrowly so. Calyces slightly tinged with red; the transverse line of dehiscence at first not very distinct; lid of very thin consistence, $\frac{1}{4}$–$\frac{1}{3}$ inch broad, adhering often for some time after the expansion of the stamens to the tube of the calyx. Filaments beautifully cinnabar-red, occasionally verging to a lighter coloration, but never very pale. Anthers not large for the size of the flowers; filaments not very thin. Style long and slender. Fruit 1 to $1\frac{1}{2}$ inches long, faintly streaked; its orifice downward not contracted; valves at first flatly converging, at last quite descending. Appendage of the seeds about as long as the nucleus or even longer, decurrent along the back of the kernel, transparent, of a slightly brown tinge.

The specific name of this gorgeous tree was chosen before the brilliancy of its flowers was known, and alludes to the similarity of the leaves to those of Fig-trees of the series of Ficus elastica, the principal Caoutchouc-tree of India.

E. calophylla is the only species, to which E. ficifolia bears very close alliance, and both might on account of their bark be placed in the series of Bloodwood-trees, among which E. corymbosa and E. Abergiana show moreover resemblance as regards leaves, disposition of flowers and structure of fruits. The characteristics, by which E. ficifolia can be distinguished from E. calophylla, are as follow: The tree is of less height, the bark is somewhat more deeply furrowed, the leaves are proportionately not quite so broad but longer, the flowers are mostly larger, the calyces assume a reddish hue, the filaments are of a splendid crimson, the fruits less turgid, while the seeds are much paler in color, have a smaller kernel and are provided with a conspicuous appendicular membrane. Irrespective of this a very marked difference in the seedlings is observable, as those of E. ficifolia show only slightly or not at all the bristly roughness of E. calophylla, nor are the seedling-leaves inserted above their base to the stalk as in that species.

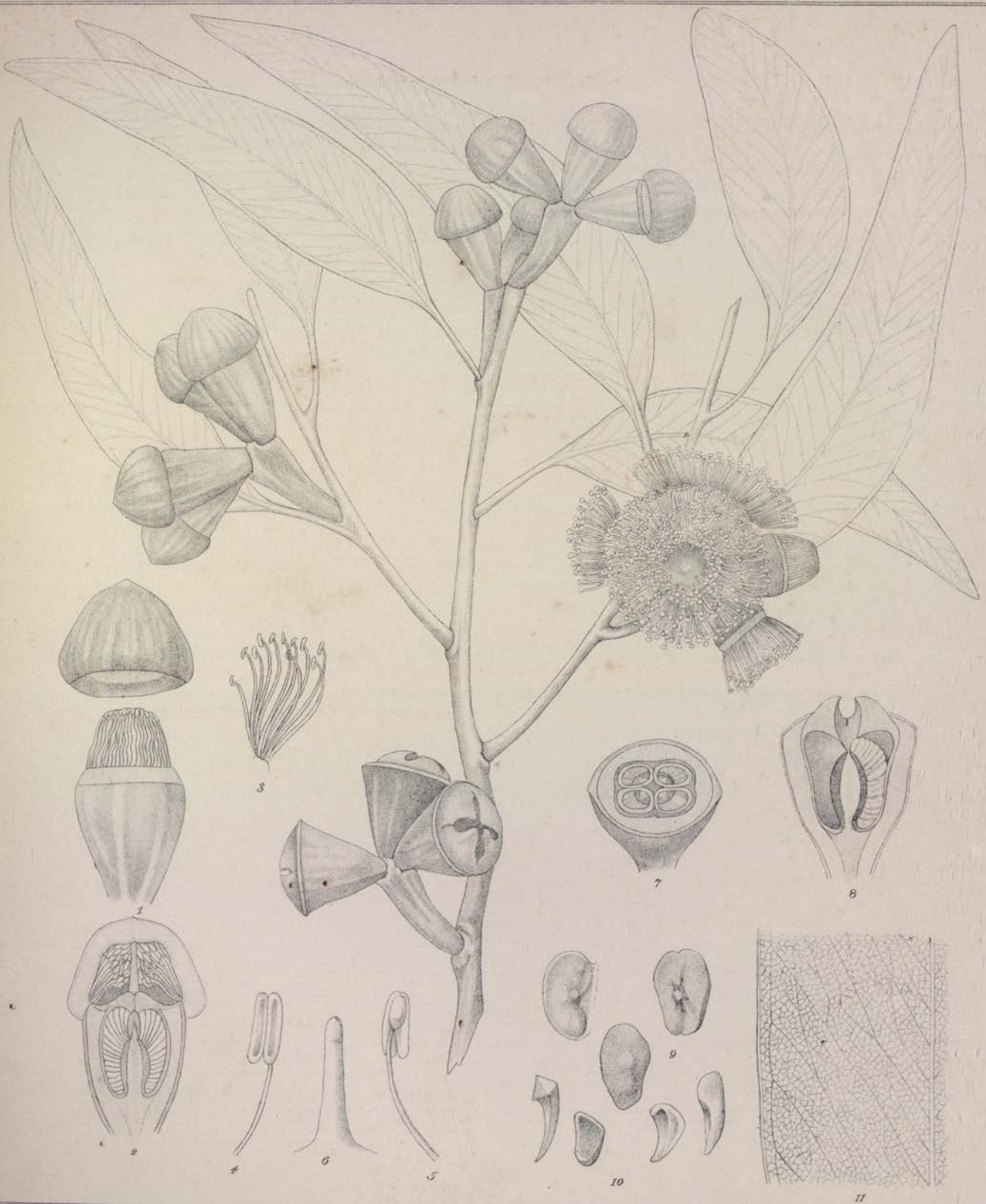
If it were necessary to point out any differences of E. corymbosa and E. Abergiana, we need only allude again to the color of the stamens;—besides E. corymbosa has its flowers and fruits

smaller, the seeds wholly or nearly destitute of any appendage and the seedlings purplish-hispid with short-stalked elliptic opposite leaves; while E. Abergiana is still further removed by the want of stalklets of its flowers and by the larger and wider lid, although the seeds are here again conspicuously appendiculated.

This Eucalyptus is one of the most splendid of recent acquisitions to horticulture, and was introduced by the writer of this work into the Botanic Garden of Melbourne in 1860, where it flowered already a few years afterwards, while yet only in a bushy state. Soon subsequently he commenced to introduce it abroad. "Hardly anything more gorgeous can be imagined, than the forests of E. ficifolia about the end of January or commencement of February, when the brilliant trusses of flowers diffuse a rich red over the dark-green foliage of the whole landscape occupied by this tree." It should have a place in every select ornamental arboretum in zones free of frost and excessive heat.

Whether the timber of E. ficifolia has any particular qualities to recommend it to artisans, remains as yet unknown. The Kino of the wood and bark has, like similar exudations of other Eucalypts, value in medicine and for tan- and dye-purposes. The trade in seeds of this species has proved already to vendors remarkably profitable, and is likely to be carried on by the seedsmen for lengthened periods. Parrots and many other kinds of birds visit the tree, to pick the sweetish flowers and the seeds.

EXPLANATION OF ANALYTIC DETAILS.—1, an unexpanded flower, the lid lifted; 2, longitudinal section of an unexpanded flower; 3, some stamens in situ; 4 and 5, front- and back-view of an anther, with portion of its filament; 6, style and stigma; 7 and 8, transverse and longitudinal section of a fruit; 9 and 10, fertile and sterile seeds; 11, embryo in situ; 12, embryo uncoiled; 13, transverse section of embryo; all the figures except 7 and 8 magnified, but to various extent.



Todt. del. C. Troedel & Co Lith.

F v M. direxit

Steam Litho Gov Printing Office Melb

Eucalyptus gomphocephala, *De Candolle*

EUCALYPTUS GOMPHOCEPHALA. 64

De Candolle, prodromus systematis naturalis regni vegetabilis iii. 220 (1828); mémoire sur la famille des myrtacées, planche 11; F. v. M., fragmenta phytographiæ Australiæ ii. 36; Bentham, flora Australiensis iii. 231; F. v. M., Forest-resources of Western Australia 9, plate 8.

Tall; leaves scattered, lanceolar-sickleshaped, on rather long stalks, shining, but slightly paler beneath, their veins very thin, rather close, only moderately spreading, the circumferential vein very close to the edge; oil-dots concealed or obliterated; umbel-stalks broad, much compressed, axillary, solitary, bearing from 2 to 6 flowers; stalklets none or exceedingly short; *lid hemispherical, thick, rough, somewhat streaked, considerably broader than the tube of the calyx* and only slightly shorter; the latter broadly obverse- or semiovate-conical at first, widening afterwards; *outer stamens almost straight in bud,* inner stamens more or less inflexed before expansion, all fertile; anthers oblong, opening lengthwise by parallel slits; style somewhat shorter than the stamens; stigma not dilated; fruits topshaped- or bellshaped-semiovate, 4-celled, *rim of the ripe fruit exserted, broad, somewhat turgid;* valves deltoid; seeds without any appendage, the sterile not much or hardly smaller than the fertile seeds and few of them narrow.

In the coast-tract from the Moore-River to Geographe-Bay in West Australia, seemingly always in the limestone-formation.

The "Touart" or "Tooart."

A good-sized, rather shady tree, as noticed by myself near Bunbury, with finally stout stem, the whole height of the tree reaching to 120 feet with a clear trunk sometimes up to 50 feet. Bark persistent, rough and rather dark but not stringy on aged stems, greyish and smooth on younger trees and branches. Branchlets somewhat robust. Leaves of rather thick consistence; their veins not prominent; stomates about twice as many beneath as above. Calyces neither smooth nor shining; lid hard, of remarkably thick structure. Filaments pale-colored; dorsal gland of anthers conspicuous. Fruit-valves depressed, finally pyramidally erect.

E. gomphocephala is phytographically one of the most marked of all species of the extensive genus, although habitually not altogether dissimilar to E. marginata; the lid broadly protruding beyond the calyx-tube separates the species already from all congeners, except E. Watsoniana and E. robusta, but in neither of these two is the turgescence and disproportionate width of the lid (which induced De Candolle to construct the specific name of the Tooart) equally remarkable, the two last mentioned species being besides very different in other respects. The slight expansion of the lid beyond the calyx-tube, as shown by E. corynocalyx and E. urnigera, can here not come into consideration. E. gomphocephala might systematically be compared to E. megacarpa, if the broadness and bluntness of the lid were kept out of view; still the roughness of the bark, the thicker consistence of the leaves, the heterogenous stomates, the stamens mostly straight in bud, the narrow anthers, the fruits longer than broad with perhaps never more than four valves already offer marks for easy distinction.

I have given the geographic limitations of this species as recorded on the forest-map of West Australia recently issued by the Survey-Department of Perth (Swan-River); but Mr. Oldfield noted in his collection a sprig as gathered north of the Arrowsmith-River. Mr. A. C. Gregory, C.M.G., the renowned geographic explorer, observed that this tree is restricted to a calcareous sandstone formed by the wind-drifts of sea-sand of later tertiary date; the tree thus occurs only in the vicinity of the ocean.

The wood of the Tooart is of a pale-yellowish color, remarkable for hardness and strength, very heavy, of a close and twisted or even curled grain, rendering it very difficult to cleave it, and (what in Eucalyptus-timber must particularly be regarded as a valuable quality) showing no aptness to rend. Mr. Laslett, timber-inspector to the British Admiralty, speaks in terms of the highest praise of this wood. According to his authority it is a very sound timber, possessing few or no defects; it shrinks very little in seasoning, will bear exposure to all the vicissitudes of weather for a long time without being affected by it; after being exposed for fully ten years it was found to open out with all the freshness of newly-felled timber. It is sought for in shipbuilding for beams, keelsons, sternposts, engine-bearers, and for other works below the line of floatation, wherever great strength is required and a weighty material is not objectionable. Laslett thinks that it would also make good piles for piers and supports in bridges, and likely be useful in the framing of dock-gates. Its toughness befits this wood specially for wheelwrights' work. Experiments on its strength gave the following results: Average of six tests for transverse strain S = 2,701, compared with 2,117 for British Oak; direct cohesion (tensile strength) per square inch 10,284 lbs. against 7,571 for Oak; vertical or crushing strength per square inch 4·174 tons against 2·194 tons for Oak. The specific gravity of Tooart-wood was found to be in average 1,169 (Laslett, Timber and Timber-trees pp. 188–189). Logs 45 feet long and 28 inches square have been obtained.

Wherever in mild climes limestone-country near the sea-shore is to be clothed with forest-vegetation, the Tooart would claim indeed high consideration among hardwood-trees; it was first brought under culture in the Melbourne Botanic Garden now many years ago.

The tree is in flower from January till June.

EXPLANATION OF ANALYTIC DETAILS.—1, unexpanded flower, the lid lifted; 2, longitudinal section of the same; 3, some stamens in situ; 4 and 5, front- and back-view of an anther with portion of its filament; 6, style and stigma; 7 and 8, transverse and longitudinal section of a fruit; 9 and 10, fertile and sterile seeds; 11, portion of a leaf; all magnified, but variously.

Todt del. C.Troedel & Cº Lith. P.v.M. direxit. Steam Litho Gov Printing Office Melb.

Eucalyptus marginata. *Smith.*

Smith, in the transactions of the Linnean Society of London vi. 302 (1802); W. T. Aiton, hortus Kewensis, second edition, iii. 192 (1811); Sprengel, systema vegetabilium ii. 500; De Candolle, prodromus systematis naturalis regni vegetabilis iii. 217; G. Don, dichlamydeous plants ii. 818; D. Dietrich, synopsis plantarum iii. 121; Bentham, flora Australiensis iii.; F. v. M., Report on the Forest-resources of Western Australia p. 3–4, pl. i. xviii. fig. 1–3, xix. fig. 1 and 2; E. floribunda, Huegel, enumeratio plantarum Novæ Hollandiæ austro-occidentalis 49; Schauer, in Lehmann plantæ Preissianæ i. 128; F. v. M., fragmenta phytographiæ Australiæ ii. 40; E. hypoleuca, Schauer, in Lehmann plantæ Preissianæ i. 131; E. Mahagoni, F. v. M., fragmenta phytographiæ Australiæ ii. 41.

Finally tall; *leaves* scattered, from oval- to narrow-lanceolar, slightly or distinctly curved, *somewhat paler and not shining underneath;* their lateral veins subtle, numerous, pennately spreading, the circumferential vein at a slight distance from the edge of the leaf; oil-dots copious, transparent or more or less concealed; umbels axillary and solitary, on conspicuous slender sometimes compressed stalks, with 3–12 flowers; tube of the calyx semiovate or somewhat top-shaped, gradually attenuated into a rather short or moderately elongated stalklet, not angular, hardly half as long as the conical or rarely hemiellipsoid lid; *stamens all fertile, not bent back while in bud; anthers cordate-kidneyshaped,* opening by longitudinal slits; style elongated; stigma not expanded; *fruits ovate-globular,* truncated, the margin of the summit rather narrow, but finally flat; valves three, short, enclosed or but slightly exserted; seeds all very angular and without any appendage, the sterile mostly not narrow, but smaller than the rather large fertile seeds.

From King George's Sound to Cape Leeuwin and to the Moore-River, forming the principal forests in South-Western Australia and occupying a region not far removed from the coast.

This tree, the famous "Jarrah" of South-Western Australia, there passing also as Mahogany-tree, rises exceptionally to a height of about 150 feet, good-sized trees averaging 100 feet. Stems have been measured 80 feet to the first branch and exceptionally 35 feet in circumference at 5 feet from the ground, and even instances are on record of the stem having attained a girth of 60 feet at 6 feet from the ground through the formation of buttresses. The bark is persistent and somewhat fibrous, wherefore the East-Australian term of Stringybark-tree might be applied to this species also. Branchlets rather slender, angular. Leaves on conspicuous more or less compressed stalks, sometimes of a more papery, sometimes of a more leathery thickness, variable in length and also in comparative width, occasionally only about 2 inches long and more ovate, often terminating in a narrow acumen. A few of the umbels in exceptional cases forming a small terminal panicle. Stalklets usually of about the same length as the calyx-tube, but sometimes twice as long. Lid occasionally thrice as long as the calyx-tube, long-pointed and somewhat curved. Stamens attaining a length of 5 lines, but in a small-flowered variety only half as long; filaments finely capillary, cream-colored, rarely yellow; anthers pale, their slits divergent and at the summit confluent; gland of the connective extremely minute. Style thin, as long as the stamens. Ripe fruit from hardly $\frac{1}{2}$ inch to fully $\frac{3}{4}$ inch long, neither shining, nor dark-colored. Valves broader than long, inserted not far below the orifice. Seeds forming two rows in each cell, the fertile grains $1\frac{1}{2}$ to $2\frac{1}{2}$ lines long, black, somewhat shining, much fewer than the sterile seeds, which are pale-brownish and 1 to $1\frac{1}{3}$ lines long and nearly as broad.

This tree received several specific names; the difficulty of recognizing it commenced soon after James Donn (in his hortus Cantabrigiensis, sec. edit. p. 101 in 1800) had established the name, but perhaps not for this species; because Sir James Smith, when in 1801 giving a very

short diagnostic phrase and quoting doubtfully Donn's notation, gave for his E. marginata, distinctly Port Jackson as the native locality; he received in 1798 his cultivated specimen from Mr. W. T. Aiton, the Director of the Royal Garden of Kew, who in the second edition of the hortus Kewensis gives no clue to the native place of growth of this species beyond asserting, that the seeds came from Archibald Menzies, the companion of Captain Vancouver in the naval expedition, during which in 1791 King George's Sound was discovered. Menzies had only at that place an opportunity to gather Australian plants and seeds, as Vancouver landed on no other port of our southern continent; hence the native locality of the Kew plant, if the seeds really came from Menzies, is placed beyond doubt. Nevertheless Sir James Smith's definition would not lead to the recognition of that species, because he compares the leaves to those of E. robusta, but they are not so broad, nor their stalks short, while the covers (as Smith calls the lid) of the calyces are said to be not longer than the tube; all this is at variance with E. marginata, as now understood, while the last-mentioned characteristic given by Smith would well compare with E. pilularis, from which however he distinguished it by the oval leaves, a characteristic not generally applicable to E. marginata. Again De Candolle did not indicate (as in the case of E. cornuta), that E. marginata came from the south-western coast, nor did any of the earlier writers refer to the form of the anthers, first made use of for diagnostic purposes by myself, which note at once would have led to the recognition of E. marginata among western species. Mr. Richard Kippist, the librarian of the Linnean Society, when kindly inspecting for me the typical specimens of Eucalypts in Sir James Smith's collection, supposed also, that this like nearly all others of the early described congeners came from the environs of Sydney (*vide* fragm. phyt. Austr. ii. 174). That the tree received several specific names arose also partly from the circumstance, that the bark was variously described by collectors; hence E. floribunda was regarded as distinct on account of its smooth bark (belonging to the Leiophloiæ); but we are now aware, that this observation of several collectors referred only to the young state of the tree, before the cortical layers could sufficiently accumulate to assume the thickness and roughness shown by that of any species of the Pachyphloiæ (or perhaps Rhytiphloiæ), to which E. marginata really pertains. Again E. hypoleuca bore a misleading name, not applicable to any but very exceptional forms of the Jarrah. The original specific appellation also gave no clue, as the margin of the leaves of E. marginata is not more thickened than in many other species, particularly those with rather horizontal than vertical leaves, in all of which the edge rolls slightly back.

E. marginata is the only tall West-Australian species belonging to the Renantheræ, but E. buprestium and E. santalifolia (E. pachyloma, Benth.) are also there referable to that section of the genus, although the anthers of the last mentioned are rather more heartshaped; it agrees also with most congeners of that series in having the seeds mostly of uniform shape, though not of equal size.

In comparing the diagnostic marks with those of other species, it may be observed, that E. buprestium is only a small tree with bark more like that of E. patens (the West-Australian Blackbutt-tree), moreover its leaves are narrower, more prominently veined, of equal light-green color and producing stomata in equal numbers on both sides, the lid is hemispheric and thus shorter than the calyx-tube, the stamens are, on account of the shortness of the lid, while in bud, quite turned downward, the fruits are larger, not rarely 4-celled and provided with only very short or hardly any stalklets, their rim is descending and the orifice proportionately still more contracted.

E. santalifolia is distinguished by its shrubby growth, has leaves much like those of E. buprestium, the leaf-stalks short, the flower-stalklets thick and very abbreviated, the lid broader, the anther-cells rather less divergent and fruits like E. capitellata and E. macrorrhyncha.

The Jarrah in its humid native region seems more indifferent to soil and situations than most other Eucalypts, but it avoids hot and dry tracts of country. I saw it descend on sandy ridges and calcareous declivities close to the sea-shores, traced it as a shrub to the rocky summits of the Stirling's Range (nearly 3,000 feet high) and noticed it to come down even to wet flats. But its development for extensive timber-forests takes place on the ranges of older rocks, still within the influence of the sea-air, as shown on the forest-map issued by the Hon. Malcolm Fraser, the Minister of the Lands Department of West Australia ;—thus it extends seldom beyond fifty miles from the coast, and where it stretches farther inland, as towards the sources of the Blackwood-River, the Jarrah-forests meet in a comparatively moist region the cooling influence both of westerly and southerly breezes from two different shores ; but the mountainous nature of the country in that direction and possibly its geologic configuration may also be the cause of the tree there trending more inland. Jarrah-trees do not enter to any extent the forests of the Karri (E. diversicolor) or of the Western White Gum (E. redunca) or of the York Gum-tree (E. loxophleba), the first replacing E. marginata in a broad littoral belt between Cape Leeuwin and the lower Gordon-River (and being again fronted by E. ficifolia), while E. redunca constitutes prevailingly the forests of the drier eastern portions of the coast-ranges, E. loxophleba occupying a strip of country along the middle of the E. redunca-region, thus dividing the latter into two parts ; this distribution is ruled perhaps more by climatic than by geologic agencies. Throughout nearly the whole region of its range the Jarrah is largely mixed with E. calophylla (the South-West Australian Red Gum-tree or Bloodwood-tree), which there next to E. marginata is the most frequent of the gregarious forest-trees, being interspersed as well among E. redunca as among E. loxophleba, where they predominate. Isolated patches of straggling Jarrah-trees occur in some places beyond the main-area here indicated as occupied by this species.

E. marginta is not a tree of rapid growth and therefore not one of early regeneration either, a fact which in the disposal of its pristine forests should thoughtfully be borne in mind. It flowers from October to December. The stomata of the leaves were found by us here either wholly hypogenous from 110,000 to 200,000 on a square inch, or heterogenous, varying from 50,000 to 70,000.

Mr. Aug. Gregory informs us, that some of the aboriginal tribes used to call the tree "Jerrile," that it grows principally on a concretionary ironstone, which he considers oolithic. He noticed it also on deep sands resting on ironstone-formation, but timber obtained from sand is not equal in value to that from the Ranges, and his thirty years' experience as a traveller in West Australia led him to observe, that E. marginata is confined to areas, which are within the influence of the prevailing moist south-western summer-winds.

In referring to the almost unrivalled superiority of the Jarrah-timber as well nigh indestructible and yet easily worked, we may quote here the high authority of a professional judge, Mr. H. E. Victor, C.E., Swan River, who after a long local experience reported on this wood substantially as follows for the Paris Exhibition of 1878 : "Open to air and weather, on wind- and water-line, under the soil or submerged, it is not materially affected, remaining intact after nearly fifty years' trial. The choicest timber is obtained from the summit of the granite- and ironstone-ranges ; trees grown on sandy plains near the sea yield a timber of inferior quality,

twisted, also shorter in the grain and much less durable. The forests are of considerable extent, covering an area of approximately 14,000 square miles, full of noble trees, springing from among rocky boulders to a height, clear of branches, of from 50 to 60 feet, straight as a mast, and attaining a maximum girth of 20 feet. The committee of Lloyds, on Governor Sir F. Weld's representation, informed Earl Kimberley, that this timber ranks with those named in line No. 3, table A, attached to the rules for the classification of ships. According to this estimate it was for shipbuilding second only to English Oak and to American Live Oak, standing before Sal (Shorea robusta) and Teak (Tectona grandis), the two highest class timbers of India, and also before the celebrated Greenheart (Nectandra Rodiæi) of Guiana."

The Imperial Government Clerk of Public Works of West Australia, speaking from more that twenty years' experience and use of considerable quantities of this timber, states : "It is remarkably free from the action of nearly all the ordinary forms of decay incidental to woods in contact with or buried underground, under water, at mortices and joints, in piles, in sea-jetties and in planking of sea-going vessels. Without sheathing or other protection, it has proved sound and enduring to an extent which appears to denote exemption from decay, so far as evidence can be derived from observation of timber exposed for upwards of thirty years. I have recently taken up piles, which were driven for a whaling jetty in the year 1834 or 1835 ; the timber is small but perfectly free from boring marine mollusca, although the place is swarming with Teredo. In the old jetty-work at the port of Fremantle, piles which had been driven for thirty years and others only about one year could scarcely be distinguished, both being equally sound ; large iron-bolts through them have entirely corroded away, leaving the holes clean and sound. Round piles, with only their bark peeled off, driven before seasoning, appear to stand as well as those which were squared and seasoned. Young as well as matured wood had effectually resisted the attack of boring sea-worms and crustacea. A cargo-boat, upwards of twenty years old, exposed all the time and as often high and dry as afloat, is as sound as when it was launched. Coasting craft, which had been more than ten years afloat without copper-sheathing, are perfectly seaworthy, not a plank perforated nor a butt-end rotten. A sapling pole, which had been set up to mark a shoal near Fremantle, sheathed with copper and guyed with iron-chains, was found on inspection to be uninjured after twenty years' exposure ; a chip of it was taken from the waterline with a pocket-knife and looked like Cedar, but the copper-sheathing and iron-chains had both perished. Land-boundary posts, put in forty years since, show neither weathering, nor rot, nor injury from Termites ; letters cut on them are still clean and sharp. This is the case also with slabs in the cemetery at Perth, bearing inscriptions dating as far back as 1834. Flooring of cottages, wet and dry according to the season, laid on the ground without joists, after twenty-five years show no signs of decay on either side. As Jarrah has been the timber, used throughout the colony of Western Australia since its foundation in 1829, there are numerous examples to refer to, proving its durability. Properly cut and properly dried, the material would prove in practice as durable as iron, and under some circumstances would outlive it. The time occupied in drying ought to be one month for every inch in thickness, if timber is sawn or hewn ; but if round it requires only to be banded at the ends to prevent splitting. In the forests any number of trees can be selected, to suit particular purposes, for which the timber may be required, either for round piles, or for squared logs, so also for railway-sleepers, while for furniture special selections would be necessary ; in the latter case splendid specimens may be obtained, exhibiting a play of light across the grain with a variety of mottles and lines when polished highly to give a very pleasing

effect, though the wood is too heavy for any but massive designs. Some of the protuberances from the trunks and branches are of an immense size and furnish slabs rivalling in beauty the finest specimens of Walnut or Pollard-Oak; they require however a great deal of time in seasoning before they can be made up, after being cut into slabs; it is not unusual to find such protuberances from 6 to 10 feet in diameter.

"I have drawn attention more particularly to timber intended for heavy works, such as sea-facing, dock-lining, foundations and bed-blocks for machinery. It is however equally suitable for all building purposes, framing, quartering, weather-boarding, planking, floorings, ceilings, ballusters, railings and fencing; it forms also durable cross-cut blocks for roadways and paths, easily laid and bedded in common sand. Sawn into shingles this wood makes a good, cool, light roof-covering, weighing about 450 lbs. per 100 square feet; these shingles set on sawn battens with wire-nails stand the roughest weather without stripping. There are many roofs in the colony of West-Australia covered with them, and in the course of more than twenty years they have required little or no repair; while white ants, so destructive to most kinds of timber, will not touch it, and the astringent principle in it is sufficiently strong to destroy even mice that gnaw it. It is one of the least inflammable of woods, a quality of great importance for wooden buildings in hot climes. The specific gravity of the timber averages about 1·12; if well dried, small scantlings will float in the sea, but when saturated will sink. Specimens direct from the mill will weigh from 71 to 76 lbs. per cubic foot."

Mr. Thomas Laslett gives the specific gravity as 1·010; in transverse strain he found that a piece 7 feet long and 2 inches square, with the weight suspended in the middle, broke under a load of 586⅔ lbs., with a deflection of 4·71 inches at the crisis of breaking (average of six trials); this would give for $S\left(\frac{L \times W}{4\,BD^2}\right)$ 1,800. In vertical or crushing strain it supported a weight of 7,164 lbs. per square inch (average of six experiments), English Oak bearing from 4,480 lbs. to 7,978 lbs.

Mr. James Manning, Clerk of Works at Fremantle, found the transverse strength to be from S 927 (average of eight trials) to S 1,140 (average of eight more trials).—*Perth Inquirer*, 1854.

My own experiments on the strength of different Eucalyptus-woods gave results varying from S 1,332 for E. obliqua to S 3,144 for the best E. Leucoxylon. The specific gravity of Jarrah-wood I found to be in average 64 lbs. per cubic foot of well-seasoned timber. Some other trials instituted by us here on thoroughly air-dried wood gave ·970 for the hard variety and ·820 for the soft variety of the wood of E. marginata.

The above observations will serve to show, that Jarrah-timber is unsurpassed as regards durability, that it is worked with greater ease than most other Eucalyptus-woods, but that it does not equal the timber of many congeners in strength; our own Red Gum-wood (of E. rostrata), which is nearly or perhaps quite as lasting as Jarrah, surpasses it considerably in endurance of transverse strain, and the also very durable Ironbark-wood (of E. Leucoxylon) is more than twice as strong on an average (*vide* tables under E. globulus), so far as we have observed here in local experiments.

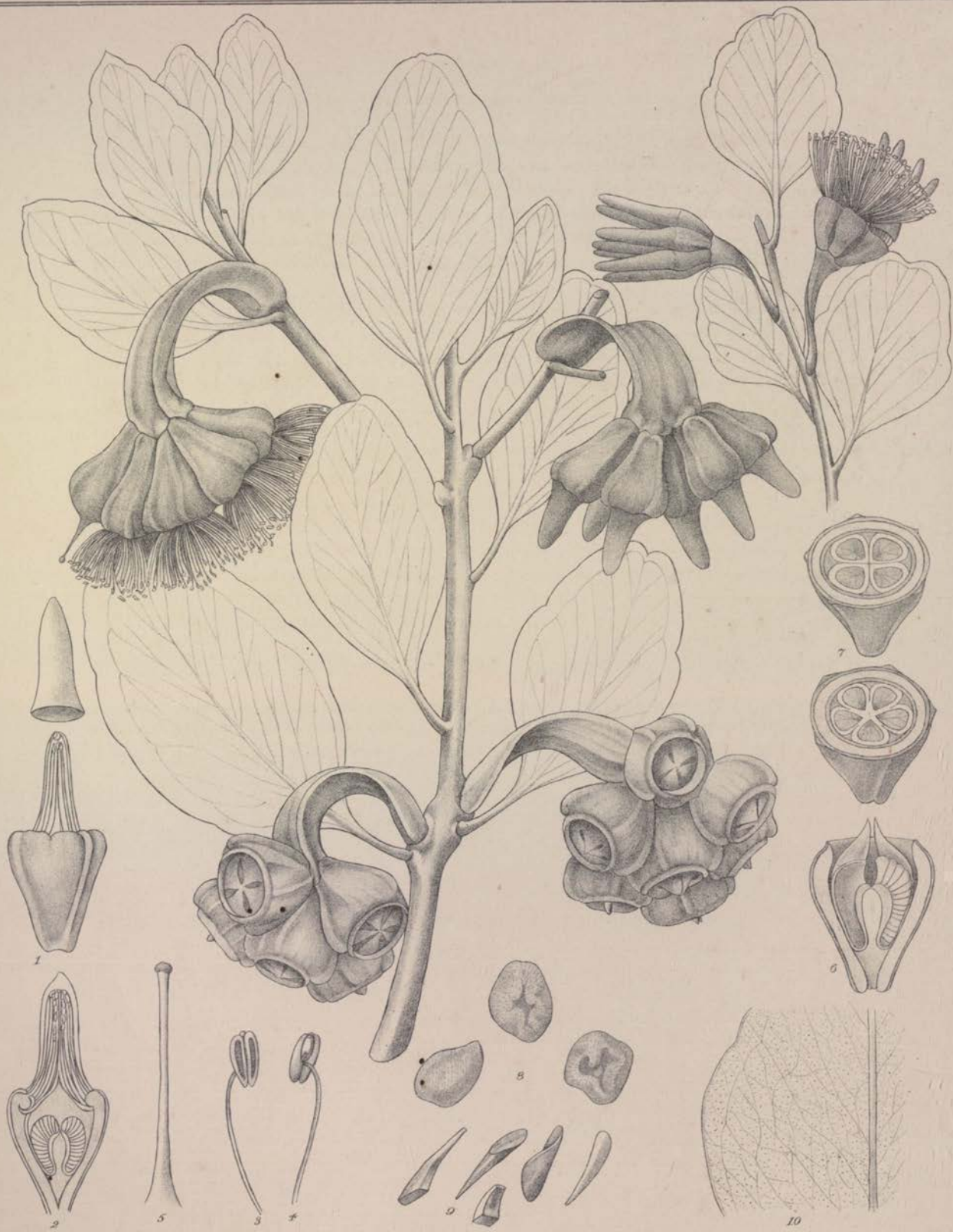
In my "Report on the Forest-resources of Western Australia," furnished after a tour for special research, it is stated already, that the timber of E. marginata, when judiciously selected from hilly localities, when cut while the circulation of the sap (during the autumn) is least active, and when dried with proper care, proves impervious to the borings of the marine crustaceous

Chelura and Limnoria, also the Teredo sea-mollusk and likewise the Termites, having in this respect perhaps no other Australian competitor than E. rostrata, so that Jarrah-wood is in extensive demand for jetties, piles, railway-crossties, fence-posts, telegraph-poles, all kinds of underground structures, the planking of ships beneath the line of floatation and also for flooring. It was further noticed that the timber from hills is darker, tougher and heavier than that from plains. The more deeply saturated color of the wood depends on the greater quantity of a phlobaphenic substance, chemically distinguished as Kino-red, which pervades the cavities of the vascular and cellular tissue of the wood; it is readily revealed by the microscope. Attention was drawn to this preservative substance, which remains unchanged by water and dissolves only in alkaline fluids, already in the Jurors' Report for the Victorian Exhibition of 1862, more particularly through Dr. J. Coates. To this antiseptic principle Jarrah-wood owes seemingly its extraordinary durability, it being developed (so far as our observations went) to the extent of 16 to 17 per cent. (in air-dried wood), the percentage being as much as that in E. rostrata and from twice to five times as much as in the other West-Australian timbers hitherto examined. It is also a significant fact, that the Kino-red is most richly stored in the harder and darker sorts of Jarrah-timber, which is known to be the most perfect in its resistance to decay. In my work on "Select Plants for Industrial Culture and Naturalisation" (*see* Indian edition, p. 114) it is also already mentioned, that Jarrah-wood furnishes one of the best materials for charcoal.

In correct appreciation of E. marginata for forest-culture it should however be mentioned, that this species, which I first of all brought under culture here and caused to be reared also to some extent in many places abroad, has not shown at Melbourne that celerity of growth, which many other Eucalypts exhibit; still its development may be more rapid in wooded mountainous tracts of country.

The vastness of its treasure in this timber for Western Australia may be estimated when we reflect that E. marginata stretches uninterruptedly through a length of 350 miles parallel to the coast, and that a multitude of shipping places at no great distance from the forests give ready access to the traffic in this most valuable timber.

EXPLANATION OF ANALYTIC DETAILS.—1, an unexpanded flower, the lid lifted; 2, longitudinal section of an unexpanded flower; 3, some stamens in situ; 4 and 5, front- and back-view of an anther with portion of its filament; 6, style and stigma; 7 and 8, transverse and longitudinal section of a fruit; 9 and 10, fertile and sterile seeds; 11, embryo in situ; 12, embryo uncoiled; 13, portion of a leaf; all the figures magnified, but to various extent.



Todt. del. C Troedel & Cº Lith. F v M direxit. Steam Litho Gov Printing Office Melb

Eucalyptus obcordata. *Turczaninow.*

EUCALYPTUS OBCORDATA. 66

Turczaninow, in Bulletin de l'Académie de St. Petersbourg, 1852, p. 416; E. platypus, Hooker, icones plantarum 849 (1852); Bentham, flora Australiensis iii. 234; E. nutans, F. v. M., fragmenta phytographiæ Australiæ iii. 152.

Shrubby or arborescent; branchlets robust, not angular; *leaves scattered, short, obcordate- or oval-roundish or broad-oval,* of very thick consistence, equally green and shining on both sides, often somewhat wavy and slightly crenulated at the margin, their lateral veins only moderately spreading, neither prominent nor crowded, the circumferential vein at some distance from the edge of the leaves; oil-dots copious and rather transparent; *umbel-stalks long, axillary, solitary, broadly flattened, mostly much recurved,* bearing generally from 5 to 7 or sometimes less and occasionally only 2 flowers; stalklets none or very short; *tube of the calyx prominently angular, considerably broader than the conic-cylindrical lid* and about as long or very considerably shorter; stamens all fertile, *filaments dark-red or pale, straight while in bud,* anthers oblong, opening by parallel slits longitudinally; style about as long as the stamens; stigma somewhat dilated; *fruits* rather large, almost semiovate or truncate-ovate, attenuated at the base, *lined with usually four sometimes keel-like angles,* 4- to 5- rarely 6-celled, rim narrowly prominent; valves slightly sunk, deltoid and short-acuminate; seeds all without any appendage, the fertile seeds blunt-angled, dotted-streaked, the sterile seeds mostly shorter and always narrower.

From the northern extremity of Stirling's Range extending to Phillips's Range and to near Bremer's Inlet, forming in many places almost impenetrable thickets; Maxwell.

A tall shrub or small tree, rising finally to 30 feet or perhaps even higher. Bark smooth, greyish. Leaves conspicuously stalked, leathery-thick, 1 to 2½ inches long, verging occasionally into a rhomboidal form, somewhat oblique especially at the generally blunt and sometimes truncated or even retracted summit, often considerably broader than shown in the drawing, thus even of greater width than length. Flowerstalks from 1 to nearly 2 inches long, from a third to fully half an inch broad, flatly compressed, but slightly concave above and convex beneath, more or less deflexed and thus often quite arched, in an early stage provided with two opposite bracts of navicular-oblong form and of about ⅙ inch length. Flower-stalklets, when present, sharply angular. Lid suddenly expanded at the base, nowhere angular; two of the angles of the calyx frequently more strongly prominent. Filaments either of a saturated but rather dull-red or yellowish-white. Anthers centrally fixed, pale-yellowish. Style slender. Ripe fruits ½ to ¾ inch long, only slightly contracted at the orifice; their rim narrowly protruding beyond the summit-line of the calyx-tube. Apex of the valves passing into the base of the style and thus the terminal portion short-exserted. Fertile seeds not fully a line long; some of the sterile seeds considerably longer than the rest.

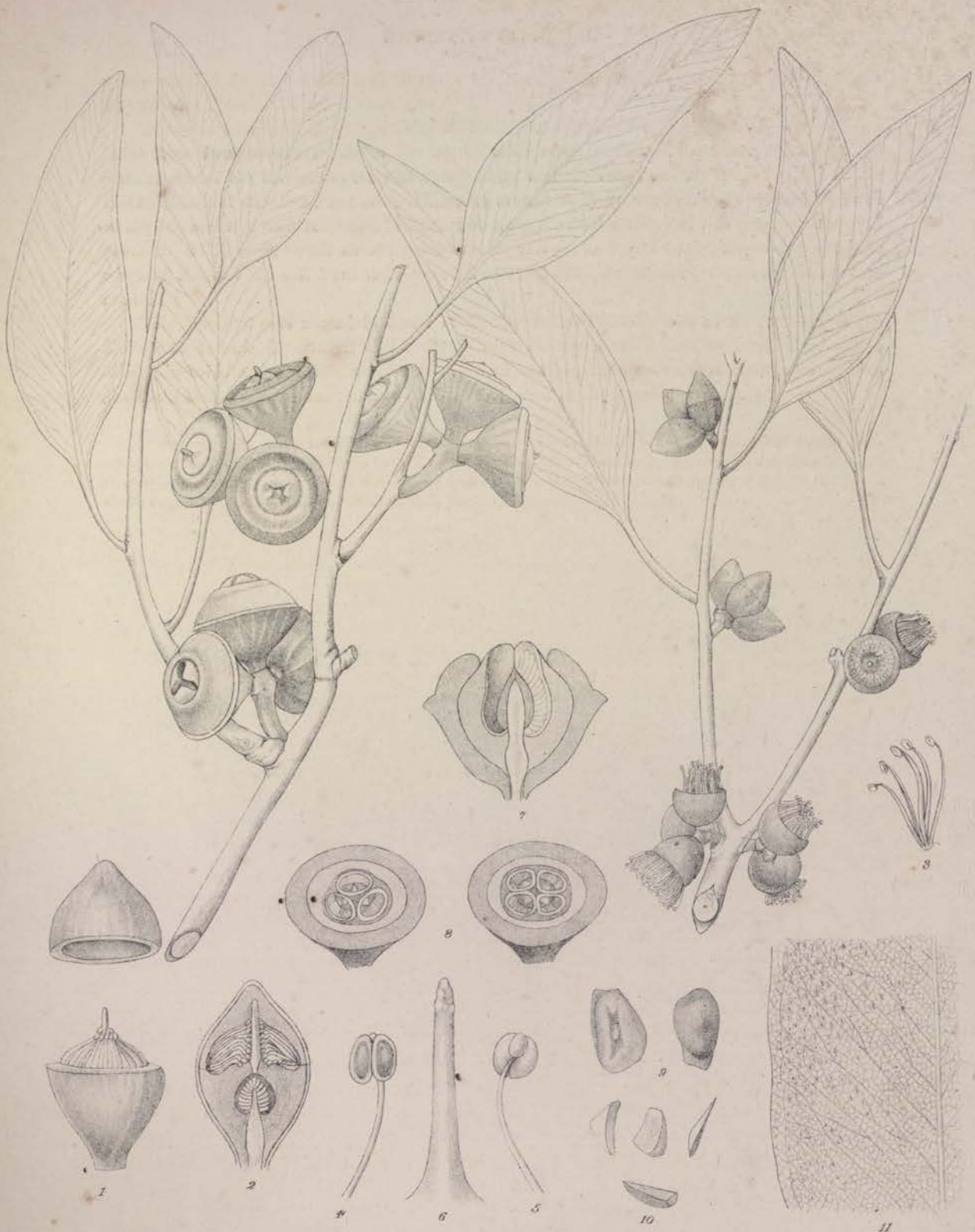
This is the "Maalok" of the Aborigines, who must have bestowed that particular designation on this Eucalypt for some obvious reason, be it for its odd appearance or the obstruction offered by its thickets or the utility of its wood; I am not acquainted with the meaning or derivation of this aboriginal word. The foliage of this species, which is sure to yield oil copiously, reminds of that of E. alpina, a species in other respects very different. The specific designations given respectively by Sir William Hooker and by Turczaninow arose simultaneously, specimens having become accessible to both from Drummond's fifth collection, to which this plant was supplied by the late Mr. George Maxwell, whose worldly career came lately at a very venerable age suddenly to its close, while he moved about to the last with an ardent and unchanged interest among the

rich vegetation around him. I have preferred Turczaninow's appellation, as Hooker's clashed to some extent with that of E. platypodos of Cavanilles and is applicable to many species, although the specific name adapted by the Moscow phytographer does not apply to all the forms of this rather variable plant, but it is very expressive of the unusual shape of the leaves. Hooker described the filaments as sulphur-yellow, and this discrepancy from the plant, defined by me in 1863 as E. nutans (together with some other slight differences) led me to regard E. nutans then as a distinct species.

In the small section of Orthostemoneæ, to which E. obcordata belongs, it is readily enough distinguished by the form of its leaves, although we may not be fully aware of the variability displayed by them. From E. cornuta it differs chiefly besides in foliage also in lesser height, in the broader and longer flowerstalks, generally shorter lids, color of filaments, very angular fruits and short valves; but a variety is depictured on the plate of E. obcordata, which approaches in the form of the calyces rather closely E. cornuta. The differences, by which this species is separated from E. occidentalis, consists again in the broadness of the leaves and very angular fruit-calyces, further in the absence of well-developed stalklets of the flowers, larger and particularly wider fruits on still longer and broader stalks.

The red-flowered variety of E. obcordata has some claims for admission into ornamental shrubberies on account of the coloration of its filaments. It would form also excellent shelter-copses and could be grown on poor soil and in an arid clime. Bentham records having seen in R. Brown's collection an Eucalyptus in very young bud and fruit from Goose-Island-Bay, seemingly referable to E. obcordata, though the leaves were ovate-lanceolar.

Explanation of Analytic Details.—1, unexpanded flower, the lid lifted; 2, longitudinal section of an unexpanded flower; 3 and 4, front- and back-view of an anther, with portion of its filament; 5, style and stigma; 6, longitudinal section of a fruit; 7, transverse section of two fruits; 8 and 9, fertile and sterile seeds; 10, portion of a leaf; all magnified, but to various extent.



Tuxll. del. C.Tisdel & C.ᵗ Lith.

F.v.M. direxit.

Steam Litho Gov. Printing Office, Melb.

Eucalyptus Oldfieldii. *F.v.M.*

F. v. M., fragmenta phytographiæ Australiæ ii. 37 (1860); Bentham, flora Australiensis iii. 237.

Shrubby; leaves scattered, on rather long stalks, ovate- or narrow-lanceolar, hardly or slightly curved, of thick consistence and of equal color on both sides; their *veins very subtle*, rather close, moderately spreading, the circumferential vein slightly removed from the edge of the leaf; oil-dots concealed or obliterated; flowers 3 or sometimes 2 together on axillary solitary mostly short stalks and provided with only exceedingly short or no stalklets; lid hemispherical, shortly protracted at the summit, of thick consistence, hardly longer than the semiglobular not angular tube of the calyx; *outer stamens not inflexed before expansion*, inner stamens only slightly bent inward while in bud, all fertile; *anthers globular-cordate*, opening by wide longitudinal slits; stigma not expanded; *lower half of the ripe fruit depressed-hemispherical, upper half consisting of the very broad convex rim and the three to four deltoid-pointed perfectly exserted valves;* the fertile seeds imperfectly and quite narrowly membraneous at the margin, larger than the partly narrow sterile seeds.

From Champion-Bay (Walcott) to the Murchison-River (Oldfield).

A shrub, attaining (so far as we know) about 10 feet in height. Young branchlets angular. Leaves from 2½ to 6 inches long, about the middle ½ to 1½ inches broad, smooth and somewhat shining, pale-green. Flowerstalks ⅛ to ½ inch long, not flattened. Stalklets ⅙ inch or less long or quite obliterated. Lid somewhat woody, very thick for its size. Filaments, as far as seen, only about 1½ to 3 lines long, seemingly of a yellowish or reddish color. Anther-cells separated by the narrow but distinct connective. Young fruit rather sharply edged, the discal rim of it then somewhat concave and rising into a ring around the pyramidally connivent valves; ripe fruit from scarcely ½ inch to over ¾ of an inch in diameter, smooth below, the rim next to the valves narrowly depressed; valves pointed or simply acute. Ripe fertile seeds black, scarcely above 1 line long; sterile seeds unequal in size.

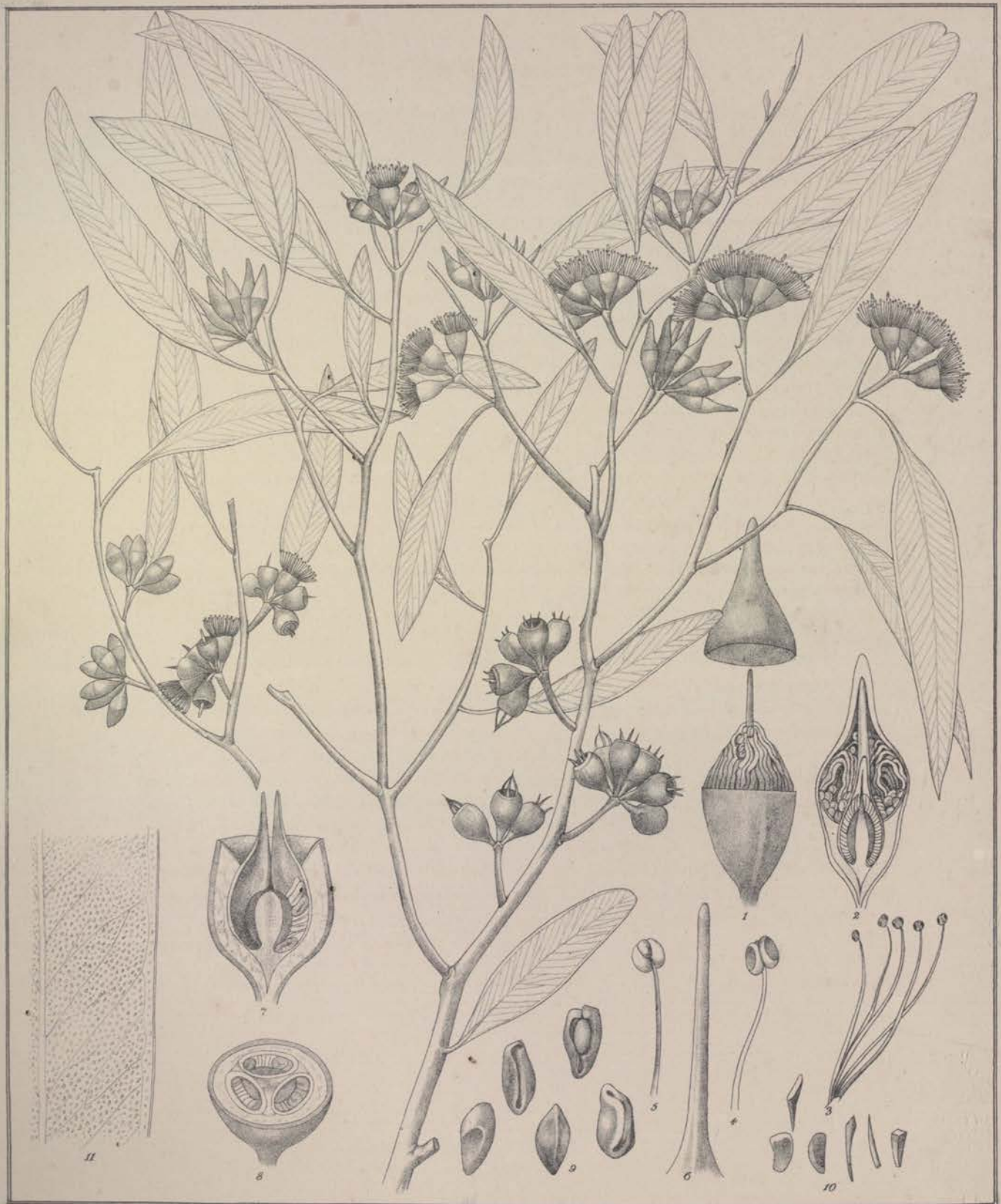
The form of the fruit already characterises well this Eucalypt. The leaves and anthers bring it into the vicinity of E. oleosa and E. pachyphylla, while the stamens as regards their early position indicate an affinity to E. gomphocephala and also E. pachyloma. Bentham placed it next the last-mentioned species, from which it is decisively distinguished by longer leafstalks, by broader leaves with more divergent veins, shorter stamens, anthers of different structure, somewhat larger more depressed fruits with prominent margin, longer valves protruding pyramidally from a central groove of the vertex and also narrower sterile seeds, the anthers and fruits (with their seeds) of E. pachyloma resembling much more those of E. macrorrhyncha and E. capitellata. For although Bentham puts his E. pachyloma in the series of Normales (Parallelantheræ), it belongs in reality to the Renantheræ, notwithstanding the lesser divergence of the anther-cells, because the anthers are heartshaped, not at all ovate, their slits are convergent and fully joined at the summit, the connective is obliterated in front, so as to render the anther-cells there completely contiguous, and the seeds are nearly uniform in size, which all is quite characteristic of Renantheræ. Indeed E. pachyloma seems reducible to the true shrubby E. santalifolia, having precisely the same anthers also, and it would therefore be one of those species of the desert (E. incrassata, E. oleosa, E. uncinata, E. gracilis), which verge from the depressed arid inland-regions of South-Eastern Australia quite to the south-western coast. In the shape of its anthers E. Oldfieldii agrees almost with that variety of E. incrassata, in which they are shortened to a

nearly roundish form; but still both these species are very different from the Renantheræ, although they offer an approach to the Micrantheræ.

The close affinity of E. Oldfieldii to E. Drummondi remains to be noted. So far as I can judge from Drummond's specimen No. 86, no other discrepancies of the latter exist than the smaller size of the leaves, flowers and young fruits, and the comparatively greater length of the flowerstalks and stalklets; but such differences are not in every other case of specific value, and as the bud and ripe fruit remained hitherto unknown, the final settling of this question is not yet possible. If E. Drummondi should prove a mere variety, as seems likely, then the geographic range of E. Oldfieldii will have to be recorded as much further southward, than we hitherto were aware.

This Eucalypt was named in honor of Mr. Augustus Oldfield, who as an emissary of the Melbourne botanic department obtained this with numerous other then undescribed plants in West-Australia, and who had previously distinguished himself by several collecting journeys in Tasmania also, where he was the first discoverer of some of the rarest alpine plants.

EXPLANATION OF ANALYTIC DETAILS.—1, an unexpanded flower, the lid lifted; 2, longitudinal section of an unexpanded flower; 3, some stamens in situ; 4 and 5, front- and back-view of an anther, with portion of its filament; 6, style and stigma; 7, longitudinal section of a fruit; 8, transverse section of two fruits; 9 and 10, fertile and sterile seeds; 11, portion of a leaf; all magnified, but to various extent.



Todt del. C. Troedel & Co. Lith. F.v.M. direxit. Steam Litho Gov. Printing Office Melb.

Eucalyptus oleosa. *FvM.*

F. v. M., in Nederlandisk Kruidkundig Archief iv. 127 (1859); fragmenta phytographiæ Australiæ ii. 56 (1860); Bentham, flora Australiensis iii. 248; F. v. M., Report on the Forest-resources of Western Australia 11, pl. 12; E. socialis, F. v. M., in Nederlandisk Kruidkundig Archief iv. 132; E. turbinata, Behr, in Nederlandisk Kruidkundig Archief iv. 137.

Shrubby or somewhat arborescent; leaves scattered, narrow- or oblong-lanceolar, pointed, slightly curved, of equal color on both sides and often pale- or grey-green; lateral veins much spreading, very subtle and rather close, the circumferential vein at some distance from the edge; oil-dots innumerable, often concealed; umbels solitary axillary and lateral, on slightly compressed and not very elongated or on even short stalks, bearing from 4 to 11 flowers; stalklets usually much shorter than the calyx; *lid hemispherical in its lower part, thence contracted into a broad- or narrow-conical summit;* tube of the calyx semi-ovate, hardly as long as the lid and generally not angular; stamens all fertile, before expansion flexuous and inflexed; *anthers roundish-ovate or almost globular,* opening by broad slits in their whole length; style slender; fruit small, truncate-ovate or almost truncate-globular, oftener three- than four-celled; *valves at the base broad, thence awlshaped, exserted;* rim flat, but narrow; seeds without any appendage, the fertile broader than the sterile seeds.

In the desert-country from near the Murray-River and its lower tributaries (F. v. M.) extending to Central-Australia (at least to the Finke-River, Revd. H. Kempe) and to the coast of South- and West-Australia.

It is this species, which forms a large ingredient of the "Mallee-scrub," constituting tall bushes branched from the root and covering (more or less intermixed with E. uncinata, E. gracilis and E. incrassata) wide particularly sandy tracts of arid inland-depressions of extratropic Australia. In the ordinary bushy state E. oleosa exceeds seldom 15 feet in height. The bark of aged plants gets corky, but comes off in patches (Tepper), while in younger plants the bark is smooth and pale. The leaves are sometimes very shining, sometimes almost opaque; their very thin veins become often quite concealed by the cuticle; the oil-glands are dark, very minute and only in young foliage pellucid through the leaf. The leafstalks are of moderate length or in a narrow-leaved variety (resembling E. angustissima) very short. The calyces are frequently pale-colored, but sometimes brownish, particularly the tube; the lid is never angular. The anthers occur sometimes cordate or even broader than long, still never reniform, nor are their slits confluent at the summit. The stigma is usually not dilated. The valves of the fruits are fragile, somewhat variable in length, but always narrow-pointed and for a long while or even permanently coherent at the summit.

In its ordinary state E. oleosa is easily enough distinguished from allied species, but some aberrant forms occur, of some of which it is as yet difficult to say, whether they are entitled to specific rank. This accounts for the synonymy of this Eucalypt. It includes also E. cneorifolia of De Candolle's prodromus iii. 220 and likewise of Bentham's flora Australiensis, so far as the plant from the arid scrubby ridges of Kangaroo-Island (Ile Decrès) is concerned, but not the plant with rough calyx and kidneyshaped anthers from the mountains of New South Wales, united with it by De Candolle, and of which he gave a figure in his Mémoire sur la famille des Myrtacées, pl. 9, which species is identical with E. stricta, as mentioned already under E. stellulata. E. uncinata in comparison can at once be distinguished by the filaments sharply infracted before expansion and not flexuous, by the anthers opening by almost terminal pores and by the shorter

fruit-valves ; specimens out of flower are however not easily referred to either species, although the leaves of E. uncinata are usually narrower and the lids shorter. E. gracilis is in a similar manner separable from E. oleosa by its anthers, which open by lateral pores; besides its outer stamens are sterile, the tube of the calyx is generally angular, the lid is much shorter and the fruit-valves are quite enclosed.

E. incrassata in its large form cannot be mistaken for E. oleosa, but its smaller variety, formerly separated as E. dumosa, is not so readily distinguished; still its flowerstalks are generally much dilated, the calyces including the lid are streaked, the anthers are mostly longer in proportion to their width, and the fruit-valves are terminated only in short points.

In Western Australia occur several kinds of trees, the precise relation of which to E. oleosa is not yet clearly understood; they are the Morrell: E. longicornis,—the Salmon-barked Eucalypt: E. salmonophloia,—the Gimlet-wood or Fluted Eucalypt: E. salubris, besides E. leptopoda and E. decipiens ;—of all of these except E. leptopoda I have given plates in the Report on the Forest-resources of Western Australia, pl. 10, 12, 13 and 14. All attain a height of about 100 feet, and E. longicornis may only be the favorably developed arboreous state of E. oleosa; its bark is totally persistent, the foliage is like that of E. salmonophloia, the lids are horn-like elongated, which characteristic suggested the name, and the outer stamens are straight in bud. E. salmonophloia has the bark smooth and of an oily and somewhat purplish lustre (hence the name), the leaves dark-green, very shining, and the outer stamens not bent inward before expansion, though the lid is not elongated. E. salubris is also smooth-barked, has the leaves dark-green, very shining and dotted with a multitude of pellucid oil-glands, the umbel-stalks compressed, the lid hemiellipsoid and therefore blunt, the anthers oval-oblong, and basifixed with broad connective and very short fruit-valves. E. leptopoda is best discerned by the many-flowered umbels on slender stalks and with exceedingly thin stalklets, nearly hemispheric fruits with broadish rim and deltoid exserted but not long-pointed valves.

Technologically E. oleosa is of some importance on account of the oil obtainable from its foliage. In kind response to a request of mine the oil of E. oleosa as well as that of E. gracilis, E. uncinata, E. incrassata and E. odorata was distilled by Mr. W. Nitschke (for the International Exhibition in Melbourne) from fresh twigs procured by Mr. O. Tepper; the following are the results (leaves constituting about half the weight of the material, the branchlets another half): 1,000 lbs. of foliage of E. oleosa yield 62½ oz. of oil (of ·911 spec. grav. at 70° F., boiling at 341° F., of rather pleasant odor and yellowish color) ; 1,000 lbs. of foliage of E. gracilis = 54½ oz. ; of E. uncinata = 69 oz. ; of E. incrassata = 140 oz. ; of E. odorata = 112½ oz. To many of the nomadic tribes, which inhabit the desert-regions, this Eucalypt is of incalculable value, as affording from the porous horizontal roots, when broken into pieces, a supply of almost pure water, by which means the natives can pass on their hunting excursions widely into the waterless tracts of the Mallee-scrub.

EXPLANATION OF ANALYTIC DETAILS.—1, unexpanded flower, the lid lifted; 2, longitudinal section of an unexpanded flower; 3, some stamens in situ; 4 and 5, front- and back-view of an anther, with a portion of its filament; 6, style and stigma; 7 and 8, longitudinal and transverse section of a fruit; 9 and 10, fertile and sterile seeds; 11, portion of a leaf; all magnified, but to various extent.

Todt. del. C. Troedel & Co. Lith.

F. v. M. direxit.

Steam Litho. Gov. Printing Office, Melb.

Eucalyptus robusta. *Smith.*

EUCALYPTUS ROBUSTA.

Smith, specimen of the Botany of New Holland 40, t. 13 (1793); transactions of the Linnean Society iii. 283 (1796); De Candolle, prodromus systematis naturalis regni vegetabilis iii. 216; F. v. M., fragmenta phytographiæ Australiæ ii. 43; Bentham, flora Australiensis iii. 228; E. rostrata, Cavanilles, icones et descriptiones plantarum iv. 23, t. 342 (1797).

Finally tall; branchlets stout, angular; *leaves large*, scattered, oval-lanceolar, pointed, of thick consistence, shining, *paler beneath, hardly or slightly inequilateral; veins copious, prominent, very spreading*, the circumferential vein rather close to the slightly recurved margin of the leaf; oil-dots much concealed or obliterated; umbels solitary, axillary, soon lateral or a few singly terminal, with 4 to 12 or exceptionally 3 or 2 flowers; their *stalk broad, strongly compressed; calyces rather large, pale, their lid hemispherical or semiovate below, cylindric- conical-pointed towards the summit, somewhat broader than the obconical-bellshaped tube of the calyx* and nearly as long or slightly longer; stamens all fertile, inflexed before expansion; anthers oblong-oval, opening by longitudinal slits; stigma not broader than the style; fruits truncated-ovate, not or but little angular, oftener 3- than 4-celled; their rim narrow; valves enclosed, permanently or long coherent, rather narrow; seeds small, all without appendage, the fertile much broader than most of the sterile seeds.

From the vicinity of Twofold-Bay (near Merimbula) to the Richmond-River, occupying wet localities, reaching possibly the most eastern regions of Gippsland.

A very large tree, passing as the principal "Swamp-Mahogany" with the colonial settlers (E. botryoides sharing in some places the same appellation), a name very inappropriate, even if the wording of "Mahagoni" was not preferable, as the classic term of the West-Indian tree (Swietenia Mahagoni, L., allied to our "Red Cedar"), which yields the unique furniture-wood of that name. E. robusta attains a height of fully 100 feet, with a stem of sometimes 50 feet length and a girth of 12 feet (W. Kirton). Limbs "massive and spreading." Bark persistent, "brittle, shelly," outside greyish, wrinkled and somewhat furrowed, "turning sometimes to a rusty color" (Fawcett). Foliage "nobly grand" (Kirton). Leaves scattered, attaining sometimes a length of 7 inches and a width of $2\frac{1}{2}$ inches, some occasionally of narrow-lanceolar form. Umbel-stalks $\frac{3}{4}$ to $1\frac{1}{2}$ inches long. Stalklets stout, merging gradually into the calyx, seldom more than half as long as the fruit, usually much shorter. Flowers rather variable in dimensions, but never very small. Style elongated. Fruit occasionally almost urnshaped, always longer than broad and often considerably so, in rare instances almost sessile on the stalk; summit of the fruit forming a very narrow ring above the calyx-tube. Valves frequently reaching to near the summit or sometimes slightly beyond it. Ripe seeds brown, hardly one line or even less long.

Dr. Leichhardt in 1843 recorded the native name as "Dadangba." In the Richmond-River district it is called "Gunnung" according to Mr. Fawcett.

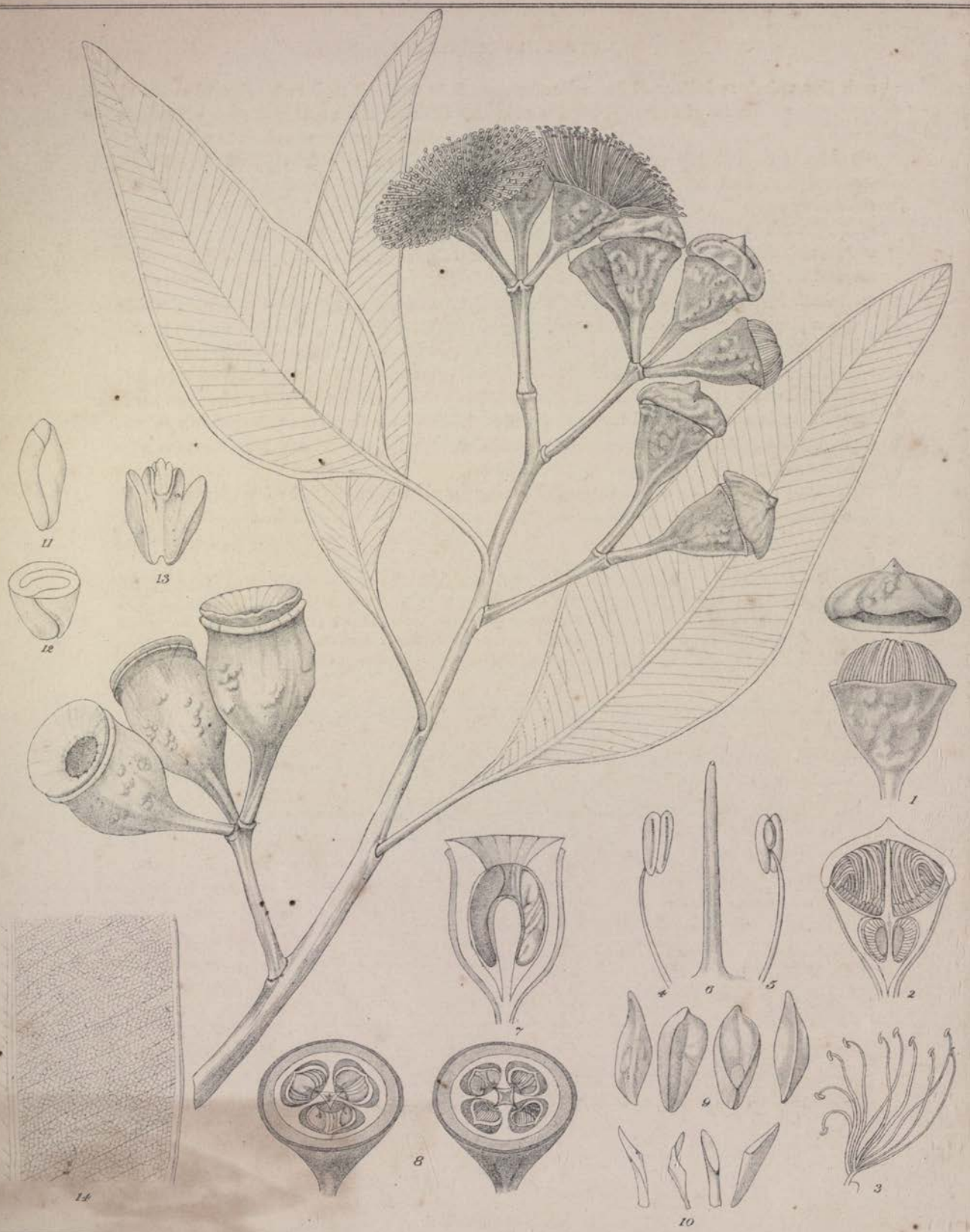
E. robusta resembles in some respects E. resinifera, but the leaves are generally broader, of a lighter color above and more shining beneath, their veins are more prominent, not almost horizontally spreading, nor is the intra-marginal vein nearly contiguous with the edge; the flowers are larger, the tube of the flowering calyx is longer and more bellshaped, the lid more turgid beneath, the fruit considerably longer, the valves are enclosed, convergent and remaining often connected at their summit, while the fruit-rim is thinner and surrounded by a narrower ring. However the variety *pellita* of E. resinifera has the large flowers and broad leaves of E. robusta, but the proportionately short fruit with exserted and mostly free, erect and acute valves of the

former. From E. saligna, which comes in most of its characteristics nearer to E. botryoides and E. resinifera, we can distinguish E. robusta already by the persistency of the bark of the latter.

As a tree for the production of fuel and of such timber, as needs not great strength, E. robusta is evidently more important than hitherto supposed, especially when we consider its adaptability to stagnant swampy or marshy localities—such as are fit only for a very limited kind of woody vegetation; but the tree seems to require for its best development access to the sea-air. Mr. Kirton writes from Bulli: "In low, sour, swampy ground near the sea-coast, where other Eucalypts look sickly, E. robusta is the picture of perfect health." The wood is reddish, difficult to split, rather brittle, but according to Woolls and Fawcett enduring well in damp places; used much for round and square posts, joists and sleepers, remarkable for its freedom from destructive insects, ascribable to the presence of Kino-red. Two pieces of timber subjected by us here to tests as regards transverse strain gave for $S\left(\frac{L \times W}{4\,BD^2}\right)$ 1,564 in average; this places the wood only at a par with E. amygdalina and E. obliqua in reference to strength; the specific gravity of air-dried wood was found to be ·930, absolutely dry ·756. Another specimen, air-dried, weighed 1·098, absolutely dry ·889. The analysis gave: 19 per cent. water, 4½ per cent. tannic acid, 19 per cent. Kino-red and 57½ per cent. woody substance. This is the largest percentage of Kino-red hitherto observed in any wood, E. rostrata and E. marginata ranking next with from 16 to 17 per cent. How far the presence of a greater or lesser quantity of this substance in Eucalyptus-timber affects its durability will have to be yet further proved; certainly its predominance in our most lasting woods appears to point it out as the main-factor in this respect. Far more favorable accounts as regards the toughness and bearing power of the wood are extant, but whether they refer to any habitually similar species (perhaps E. resinifera) or whether the timber varies much in tenacity according to its growth in low and wet or more elevated and dry ground, requires yet to be locally further investigated. The odor of the foliage is somewhat peculiar and more pleasant than that of many other Eucalypts. The tree flowers, so far as noticed, from June till December. Young seedlings, sent by the Rev. Dr. Woolls, have the stem slender and angular with leaves oblong- or narrow-lanceolar and soon scattered.

A quick-growing tree, rare in the Illawarra district, which at Lucknow attained a height of 45 feet in 10 years, and which as a species or variety I distinguished as *E. Kirtoniana*, is in flowers and fruit nearer to E. resinifera than to E. robusta, but has the leaves of almost equal color on both sides, thus far and also in shape more resembling those of E. tereticornis, while the bark, unlike that of E. saligna, is persistent. The stomates of E. Kirtoniana vary on the upper side of the leaf between 33,000 and 43,000 and on the lower page from 95,000 to 166,000 on a square inch, this great fluctuation being attributable probably to the age of the tree. It is particularly noticeable on account of its adaptability to a warm wet clime, and grew under Dr. Bonavia's care better than any other species in Oude; the technic value of its timber remained unascertained.

EXPLANATION OF ANALYTIC DETAILS.—1, an unexpanded flower, the lid lifted; 2, longitudinal section of the same; 3 and 4, front- and back-view of an anther with portion of its filament; 5, style and stigma; 6 and 7, longitudinal and transverse section of fruit; 8 and 9, sterile and fertile seeds; 10, portion of a leaf; all magnified, but to various extent.



Todl del. G. Troedel & Co. Lith.

F.v.M. direxit.

Steam Litho Gov. Printing Office Melb.

Eucalyptus Watsoniana. *F.v.M.*

EUCALYPTUS WATSONIANA. 70

F. v. M., fragmenta phytographiæ Australiæ x. 98 (1877).

Tall; leaves scattered, from ovate- to narrow-lanceolar, slightly or hardly curved, of equal color on both sides, not shining; their lateral veins very spreading, fine and copious, the circumferential vein close to the edge of the leaf; oil-dots concealed or obliterated; umbels 2- to 4-flowered, in terminal panicles, not numerous; flowers large; *lid depressed-hemispherical, very thick, short-pointed, polished-smooth, broader than the bellshaped- or topshaped-semiovate tube of the calyx*, the latter slightly longer than its angular stalklet; stamens all fertile, inflexed in bud; filaments yellowish; anthers narrow-oblong, opening by longitudinal slits; stigma not broader than the style; *fruit large, bellshaped- or urnshaped-semiovate, not angular, rim very broad*, descending, separated by a conspicuous furrow from the edge of the calyx-tube; valves 3–4, quite enclosed, deltoid; *fertile seeds large*, sterile seeds much smaller, all without any appendage.

Near Wigton on a tributary of the Boyne-River in the Burnett-District; Thomas Wentworth Watson.

A tree rising to a final height of 60 feet, so far as hitherto known. Bark persistent, wrinkled and somewhat scaly, outside brownish. Leaves scattered, of firm consistence, on rather long stalks, when well developed 4 to 5 inches long and 1 to 1½ inches broad. Umbel-stalks about one inch long. Tube of the calyx slightly warty; lid always but sometimes very much depressed, the central apex never long. Stamens exceeding the style in length. Fruit about an inch long or slightly longer, the deflexed disc around the orifice protruding very evidently beyond the calyx-tube; summit of the capsular portion of the fruit before the expansion of the valves flat. Seeds brown, shining; the fertile seeds considerably compressed, 2 to 3 lines long, sharply angular.

This seems a very rare species, as it is only as yet on record from the one locality, where the late Mr. Watson discovered it, who at once very kindly sent dried sprigs and also notes on this tree, as well as a colored sketch of a branchlet to the writer of this work. The finder saw the tree accompanied by E. maculata and E. melanophloia, according to his notes. Locally it passes as a "Bloodwood-tree"; hence it is unquestionably a rich yielder of Kino, and thus its bark may come into tanners' use. It may incidentally here be noted, that not only the bark but also the leaves of Eucalyptus-trees contain a peculiar variety of tannin, different in its action on the salts of iron and antimony, when compared to the tannic acid of our Wattle-Acacias and many other sorts of tannin, but valuable still at least as an adjunct to other tanning-materials. Comte Maillard de Marafy pointed out already several years ago, that the leaves of E. globulus could be utilized as a substitute for Sumach, although we here find them of far less tan-strength, while the leaves of E. Leucoxylon have yielded us here from dry material 9½ per cent. of Eucalypto-tannin, whereas the dry foliage of Acacia pycnantha furnished as much as 15–16 per cent. of Mimosa-tannic acid, and therefore still more approaches in its richdom of tan-principle to the genuine Sumach-leaves of Rhus coriaria. Our experiments here showed, that about four weeks were required to effect the tanning of cow-hides (which were used on this occasion) by simple immersion in the tan-liquor as obtained by decoction without any additions of other substances, whether leaves or bark were employed, except in the case of E. Gunnii, the tanning process with that species being completed in two weeks and with E. goniocalyx in three weeks. The leather obtained from leaves of E. Leucoxylon was grey-brown, hard and tough; that from the bark of E. Gunnii light-brown and rather flexible; that from bark of E. viminalis, E. goniocalyx, and E. amygdalina reddish-

brown and tough; that from the bark of E. macrorrhyncha and E. melliodora darker still than that of the preceding three; that from the bark of E. obliqua red-brown in color.

Quality of timber as yet unascertained.

The relationship of this tree is with E. maculata (which species has latterly been traced to the neighborhood of the Genoa-River by Mr. Reader), but the bark is totally persistent, the leaves are frequently a great deal broader, while their veins are finer and not quite so close, the flowers are often fewer and always conspicuously larger, the lid is ampler than the summit of the calyx-tube and seems to be simple from the commencement, although it exhibits considerable thickness; the fruits are of much larger size, rather expanded than contracted at the summit, with a flatter not suddenly quite descending rim, which latter is separated by a conspicuous circular channel from the tube of the fruit-calyx, while the seeds are larger and the fertile of these more angular.

Nearer still is the affinity to E. eximia, which has likewise persistent and structurally similar bark, also a subtle venation of the leaves and comparatively large fruits; but the leaves show the narrowness of those of E. maculata; so also the calyces have much the structure of the latter species, although they are deprived of stalklets, whereas the fruit bears close resemblance to that of E. corymbosa, a species otherwise very different, belonging to the series with hypogenous stomata and having smaller flowers with neither dilated nor polished lid. E. Abergiana might in these comparisons be left out of consideration, as it has stomata only on the lower page of the leaves, no flower-stalklets and the lid separating from the tube of the calyx by irregular rupture, a narrower fruit-rim and appendiculated seeds.

EXPLANATION OF ANALYTIC DETAILS.—1, an unexpanded flower, the lid lifted; 2, longitudinal section of an unexpanded flower; 3, some stamens in situ; 4 and 5, front- and back-view of an anther with portion of its filament; 6, style and stigma; 7 and 8, longitudinal and transverse section of fruit; 9 and 10, fertile and sterile seeds; 11, embryo in situ; 12, transverse section of the same; 13, embryo unfolded, to show the cotyledons and radicle; 14, portion of a leaf; all magnified, but to various extent.

00052694

Digitized with financial assistance from the
Government of Maharashtra
on 18 July, 2018